ABSTRACT

Dissertation Title: FRAMING IMPRISONMENT AS A TURNING
                                POINT IN THE LIVES OF CRIMINALLY-
                                INVOLVED ADULTS

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Turning points, or life events that trigger dramatic and sustained changes in behavior, are a central focus of life course criminology. Most empirical work in this domain focuses on positive turning points that decrease offending and promote desistance (e.g., marriage, employment, military service), yet there is good reason to suspect that offenders may also encounter negative turning points, which amplify rather than reduce offending. This possibility is worthy of consideration given that at least one potential negative turning point – imprisonment – is experienced by millions of offenders. This dissertation integrates the studies of imprisonment and the life course by critically assessing the joint experience of prison and parole (imprisonment) as a turning point in the criminal career, and unpacking heterogeneity in the extent to which imprisonment

serves as either a positive or negative turning point. Using criminal records of adults released from Pennsylvania prisons, this work employs a dual trajectory model to assess whether, and to what degree, imprisonment is associated with a disruption in one's offending pathway. This research also considers the life course principles of cumulative disadvantage and timing by assessing whether imprisonment functions as a different type of turning point for inmates of varying prison histories and ages.

The results indicate that imprisonment may serve as a turning point in the criminal career. Evidence of discontinuity in pre- and post-prison criminal trajectories was observed in 49.03% of the full sample, 44.78% of first time prisoners, 75.48% of repeat prisoners. First-time imprisonment almost universally served as a positive turning point, while over one-third of repeat prisoners exhibited evidence of a negative turning point. Additionally, the number of prior prison terms significantly increased the odds of observing a negative turning point relative to a positive turning point or no turning point, suggesting that the criminogenic influence of imprisonment accumulates over time. The timing of imprisonment also matters. Older inmates were more likely to demonstrate discontinuity in offending consistent with a positive turning point, whereas younger inmates were more likely to exhibit evidence of a negative turning point. The theoretical and policy implications of these findings are discussed.

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CRIMINALLY INVOLVED ADULTS

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CHAPTER 1: INTRODUCTION

The life course paradigm profoundly impacted how criminologists conceptualized and measured criminal behavior (Cullen, 2010; Laub, 2004; Laub, 2006). Specifically, scholars considered the dynamic and patterned nature of crime as it unfolds over time and focused on both continuity and change in criminal behavior across the entire life course. Four important life course principles enlivened criminological discussions: 1) structural, historical, cultural, and environmental contexts shape behavior and development, 2) the importance of the timing of life events, 3) the interconnectedness of human lives and social institutions, and 4) the centrality of human choice and agency in behavior (Elder, 1985; Elder, 1994; Sampson & Laub, 2005). The life course paradigm also prompted an appraisal of heterogeneity in offending by recognizing that there are multiple paths leading to criminal behavior, state dependent processes that maintain offending over time, and numerous ways out of crime (Laub, 2016, Sampson & Laub, 2005; Sampson & Laub, 1995). Furthermore, scholars acknowledged that life events may not be independent, but can exert cumulative influence on behavior (Elder, 1985; Sampson & Laub, 1997). In addition to theoretical advancement, new methodological approaches accompanied the life course paradigm. Criminologists now leverage the benefits of longitudinal data in new ways, use analytic techniques that allow for the assessment of heterogeneity in criminal behavior, and consider within-individual changes in crime as they unfold within a macro-environmental context.

One line of research derived from the life course perspective was the study of turning points in the criminal career. A turning point is defined as a transition or life event which has dramatic and lasting impact on the life course, such that an existing

behavioral pathway is altered (Abbott, 2001; Elder, 1986; Sampson & Laub, 1993). Life events such as marriage, employment, military service, residential change, educational attainment, parenthood, and gang membership are only some of the many life events labeled as turning points (Nguyen & Loughran, 2018; Sampson & Laub, 2016). Identifying turning points in the criminal career has direct theoretical and policy implications. Uncovering the mechanisms behind offending change prompted theoretical development (e.g., Laub & Sampson, 2003) and triggered a line of research assessing the impact of life events on criminal behavior. Armed with this knowledge, the criminal justice system could structure turning points or devise interventions to reduce offending (Laub, 2016; National Research Council, 2007).

Though research identified numerous turning points in the criminal career, most (but not all) turning points promote desistance, or reductions in criminal behavior[1]. Yet nothing in the definition of a turning point inherently suggests that behavioral change is always positive, or even unidirectional. From a theoretical and policy perspective, understanding the sources of offending amplification and desistance is equally important. If a turning point does not have a uniform effect for all offenders, it is important to know under which circumstances offending increases and decreases, and for whom. As such, it seems that there is room in the turning point literature to consider life events that have a criminogenic or a heterogeneous impact.

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[1] Certainly, exceptions to this statement exist. Nagin and colleagues' (2008) work on grade retention, Brame and colleagues' (2001) work on high school dropout, and studies of gang membership as a turning point in the life course serve as examples of this line of research. In a relative sense, though, the clear majority of turning point studies focus on offending reductions rather than amplification.

1.1. Imprisonment and the Life Course

Imprisonment likely serves as a turning point in the criminal career. After all, it disrupts an individual's entire life: removal from the community, restrictions on autonomy, strained personal relationships, gaps in employment, interrupted education, and limited political engagement, serve as only some of imprisonment's diverse consequences (for a review see Mauer & Chesney-Lind, 2004; Travis et al., 2014). Upon release from prison, individuals may face substantial barriers reintegrating to society due to housing restrictions, joblessness, and strict monitoring in the form of parole supervision. With such a broadly encompassing disruption in the life course, it is reasonable to suspect that the experience of imprisonment may serve to deflect an existing behavioral pattern or have dramatic and lasting impact on offending in ways that are consistent with a turning point. Though this argument seems rather straightforward, to my knowledge, no turning points studies explicitly consider the prison and parole experience.

In order to study imprisonment as a turning point in the criminal career, a prisoner must be released from prison such that a post-prison offending pattern can be observed. A turning point cannot be measured among inmates with life sentences or who die in prison because post-prison offending does not exist (at least in a community setting) and no relative comparison to a pre-prison offending pattern can be made. As such, if prison serves as a turning point it necessarily includes a period of community reentry and observation of the offending trajectory following the prison experience. For many individuals, re-entering the community following a prison stay includes a period of post-release parole supervision. In fact, approximately 85% of prison releases involve

discretionary parole sentences (Kaeble & Bonczar, 2015; Petersilia, 2003). In the present study, all individuals in the sample are released from prison onto parole supervision. This means that the turning point under investigation, then, is not just prison, but a combination of prison and parole supervision. Conclusions regarding discontinuity in offending before and after prison do not extend to individuals released from prison unconditionally. For the sake of brevity, in the remainder of this document I refer to this combined experience of prison and parole supervision as the "imprisonment" experience.

Empirical and theoretical ambiguity have generally hindered the assessment of imprisonment as a turning point. Numerous studies examine the relationship between imprisonment and crime at the individual level (see Nagin et al., 2009 and Villettaz et al., 2015 for reviews of this literature), and though many studies find a significant effect of imprisonment, the conclusions are mixed. On average, imprisonment seems to increase subsequent criminal behavior (Nagin et al., 2009), but empirical examples documenting the opposite effect (suggesting deterrence or rehabilitation) are not uncommon (Bhati & Piquero, 2008; Green & Winik, 2010). Similar ambiguity is found in the literature on parole supervision. Enhanced supervision of parolees may both deter criminal behavior and increase the likelihood of detecting violations and/or criminal behavior (Petersilia & Turner, 1993; Solomon et al., 2005). Criminological theory offers similarly conflicting hypotheses regarding the direction of the relationship between imprisonment and crime. These conflicts suggest that there may in fact be a heterogeneous relationship between imprisonment and crime. Different perspectives posit that imprisonment can serve as either a positive turning point by reducing criminal behavior or a negative turning point amplifying criminal behavior (per, for example, deterrence theory and labeling theory

respectively; Beccaria, 1764; Becker, 1963; Lemert, 1951). In reviewing the empirical and theoretical literature, it remains unclear exactly how imprisonment relates to future crime, and if it serves as a turning point in the criminal career.

More importantly, the study of imprisonment and its effects on the individual has not been fully integrated with the life course paradigm. Indeed, much research on imprisonment is arguably inconsistent with a life course approach. For example, most studies estimate "imprisonment effects" by comparing offending of previously incarcerated individuals and individuals who received non-custodial sanctions (e.g. Loughran et al., 2009; Nieuwbeerta et al., 2009). These studies rely on between-group differences in offending rather than analyzing within-person changes in offending over time. In most studies employing such designs, one cannot determine if imprisonment changes an offending pathway, and can only assess whether the levels of offending between groups differ after prison. Though panel data on crime and imprisonment exist (e.g. the Pathways to Desistance Study), research rarely leverages these data to see the within-person effects of imprisonment or the impact of repeated exposure to imprisonment, two central tenets of a life course approach. Additionally, the study of imprisonment and its effects on crime largely lacks longitudinal outcomes. What I mean by this is that many studies examine the prevalence of reoffending within a one to three-year window or estimate the time to re-offending, considering only the first recidivism event is considered (Allison, 2014). In contrast, a life course study of imprisonment should utilize offending trajectories to assess the patterned, longitudinal nature of criminal behavior following imprisonment (Abbott, 2001; Elder, 1986; George, 2009). Unlike the other approaches, a life course approach would ideally capture all criminal

events, their order, and the process by which criminal behavior unfolds. In the absence of perfect data to capture all attributes of criminal offending pathways, life course criminologists can focus on the progression of behavior over time, both in terms of offending level and character (e.g., versatility, seriousness).

Furthermore, imprisonment is neither a random event nor does it have a deterministic impact on behavior. Close attention to selection processes determining who goes to prison and reverse causal relationships between prison and crime pushes some criminologists to identify and estimate the exogenous impact of imprisonment on crime. Though these methods yield less biased estimates of prison's effect on crime, they also remove potentially important differences between individuals who do and do not experience imprisonment and/or feedback loops (Nguyen & Loughran, 2018). Attempts to remove endogeneity analytically may be required for causal identification, but are inconsistent with a life course approach that highlights the role of context and importance of heterogeneity.

Failure to study imprisonment through the lens of the life course paradigm has two consequences: 1) a pre-occupation with causal inference and average effects that oversimplifies the relationship between imprisonment and crime, and 2) failure to capture the context that behavior unfolds in. To the first point, in what Sampson and colleagues (2013) call the "causal revolution," criminologists are pre-occupied with establishing causal relationships between life events (or interventions) and criminal behavior. Many of the techniques employed in the fulfillment of these efforts estimate average treatment effects, depicting the relationship between imprisonment and crime as uniform for an entire sample. By extension, these methods ignore potential heterogeneity and likely

oversimplify the imprisonment-crime relationship. Imprisonment is a complex, diverse experience. The experience itself varies across place, time, facility, units within the same facilities, release communities, and parole supervision levels (Mears et al., 2015; Tahamont & Frisch, forthcoming). Prison life can look dramatically different depending on an inmate's custody level, facility security level of the facility, or the available programming. Higher custody levels are generally more restrictive of inmate autonomy, involving less time out of the cell, stricter supervision, and limited program eligibility. The same is true of parole supervision levels and the degrees of disruption to community life (e.g. number of visits to parole offices, drug test, home visits, etc.). Furthermore, imprisonment likely does not affect all individuals in a uniform fashion. Mixed findings in the imprisonment-crime literature demonstrate this point. It is possible that some people are adversely impacted and exhibit increased offending following imprisonment, while others are deterred or rehabilitated. At present, studies that rely on identification strategies that produce population average treatment effects or average effects of the treatment on treated may mask subgroup differences.

In addition to missing potentially important heterogeneity, the failure to integrate life course principles into the study of imprisonment ignores the context within which offending behavior occurs. One way this occurs in turning point studies is by removing selection and simultaneity biases through econometric identification. These methods wash away differences between individuals who do and do not experience the turning point, as well as potential reciprocal relationships wherein criminal behavior influences the likelihood of experiencing the turning point. Though there is certainly value in in discerning independent and unbiased causal relationships, these analytic techniques treat

imprisonment and offending as if they occur in a vacuum, when in fact they do not. The differences between individuals who do and do not experience turning points, or recursive relationships may be important parts of the story. Research suggests that the experience of imprisonment invades many other life domains, prompting changes in family and personal relationships, education, employment, political engagement (to name only a few), many of which are also documented sources of offending. Such complexities are important because they suggest that imprisonment is not the only thing that drives offending changes; instead, it generates a whole series of consequences such that life before and after prison may look quite different. Estimating an independent effect of imprisonment when it connects to other life domains only tells part of the story. A life course approach views context as more than just a stage on which behavior plays out, but as an additional source of criminal behavior. Deeper appraisal of the role of context in offending and imprisonment can advance both life course theory and our understanding of when and how imprisonment and criminal behavior are related.

Ignoring these aspects of the imprisonment-crime relationship results in a significant and meaningful knowledge gap. Imprisonment is a cornerstone practice in the American criminal justice system with specific goals. Among these goals are crime control, community protection, rehabilitation, deterrence, and retribution (Carlsmith et al., 2002; Spohn, 2009). Given the financial cost of imprisonment and the currently saturated correctional budgets, it is not satisfactory to guess whether these goals are being met, or to know that on average imprisonment "works". Research should identify circumstances under which this expensive endeavor is and is not meeting its goals. Given recent changes in the correctional landscape, and the number of people affected by

imprisonment, it is now an appropriate time to reevaluate claims of effectiveness. Studying imprisonment with a life course framework may provide a unique understanding of how and why imprisonment influences behavior, not just *if* there is a relationship. This can be accomplished by attending to heterogeneity in the relationship between imprisonment and crime, and assessing the context in which they occur. Failure to do this results in a less refined understanding of how imprisonment relates to behavior, such that we cannot say the extent to which the experience is detrimental or beneficial, nor for whom.

With this additional knowledge, the discipline can consider how to structure turning points to reduce offending, or at least how to diminish detrimental impacts. Laub (2016) contends that the criminal justice system can and should support positive turning points and foster behavioral change. For example, he recommends that to prevent crime, policies and programs should help individuals develop social bonds to deflect existing criminal trajectories. This task becomes more feasible if criminologists are armed with refined understanding of how interventions relate to criminal behavior, and under what conditions crime increases, decreases, or remains the same. At a time when the criminal justice system is purported to harm the individuals whom it serves (including offenders, their families, and their communities), and budgetary constraints require efficient correctional policies, a deeper understanding of the nuances of the imprisonment-crime relationship may provide a road map for policy makers. Assessment of the attributes of the imprisonment experience that lead to greater offending, or uncovering potential beneficial effects for certain groups, can inform discussions of whom to release safely, and how to avoid harm.

1.2. Present Study

This research frames the study of imprisonment within the life course paradigm by investigating the extent to which imprisonment serves as a positive or negative turning point in the criminal career. To do so, a dual trajectory framework assesses heterogeneity in offending before and after prison as well as sub-groups' responses to imprisonment without restricting the direction of change in criminal behavior. Although I focus only on imprisonment here, these theoretical and methodological advances apply to the study of turning points more broadly.

I examine sources of heterogeneity in the relationship between imprisonment and offending to address for whom imprisonment serves as turning point, and if so, in what direction. The key principles of the life course paradigm described by Elder (1994) point to two important sources of heterogeneity in turning points: the interdependence of life events, and their timing in the life course. I first consider the extent to which life experiences exert cumulative influence on behavior by investigating whether individuals with prior prison terms are more likely to experience prison as a turning point than first-time prisoners. Consistent with the life course principle of cumulative disadvantage, it is possible that the negative impact of imprisonment accumulates with repeated stays, such that imprisonment is more likely to function as a negative turning point for repeat-prisoners, and with additional prison stays. However, it is also possible that first-time imprisonment is the more profound experience, exerting the most dramatic influence on post-release behavior. Both possibilities are considered.

Second, I address the importance of the timing of a turning point by looking at age-graded transitions, examining if *when* an individual experiences imprisonment

conditions whether a turning point is observed, as well as the extent to which imprisonment serves as a positive or a negative turning point. It is hypothesized that imprisonment is more likely to serve as a negative turning point when it occurs earlier in the life course, particularly if it occurs during emerging adulthood when a variety of social bonds and capital are traditionally accrued.

I evaluate these hypotheses using a dual trajectory analytic framework to model involvement with the justice system before and after the experience of imprisonment. This modeling approach allows for an assessment of how individuals move through imprisonment by placing imprisonment as an intermediate stage, or change point, between two separate trajectories of criminal behavior. Additional methods are employed to determine whether the pre- and post-prison criminal trajectories are distinct, or involve "enough" change to constitute a turning point. To assess the cumulative and age-graded dimensions of turning points discussed above, post-estimation models determine whether number of prior prison terms and age at admission to prison independently distinguish positive and negative changes in offending. This descriptive approach marks a departure from prior work on turning points and imprisonment and crime in that it employs a data-reduction technique to identify patterns of pre- and post-prison offending and attempts to discern discontinuities if offending based on the character of those trajectory patterns. Paired with evidence of the causal effect of imprisonment and crime, this method sheds new light on how imprisonment does or does not relate to offending, and under what conditions discontinuity in offending is observed.

CHAPTER 2: LITERATURE REVIEW

The four-fold increase in the United States' carceral population since 1970 is a defining feature of the current criminal justice system. In 2016, 1.5 million individuals were incarcerated in state or federal prisons, and 630,000 were detained in local jails (Carson, 2018; Prison Policy Initiative, 2017). Another 874,800 individuals resided in the community on parole supervision following a prison term (Kaeble & Cowhig, 2018). These figures are striking relative to the 216,000 prisoners and 143,000 parolees under correctional control in the 1974 (Bonczar, 2003; Maruschak et al., 2013). Imprisonment is now an institutional force within the United States that invades many other aspects of American life. Interruptions in education and employment, dissolution of relationships between family members, strained romantic partnerships, and restrictions to political engagement serve as only a few of the many examples of this encroachment (see Travis et al., 2014), and are impacting more Americans than ever.

In light of this expansion, the imprisonment experience is much different today than in the past. Prisons are overcrowded, populations within prisons are more diverse (in term of demographic make-up as well as criminal sophistication), and individuals are confined for longer periods of time. [2] To boot, habitual offender and three-strike laws ensure that many individuals experience imprisonment repeatedly. Parole agents face heavy caseloads, boards feel pressure to release more individuals from over-crowded prisons, and the goals of parole supervision have shifted from rehabilitative to punitive in nature. The goal of today's corrections system is to manage risk rather than spend time

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[2] Imprisonment also impacts the families of individuals confined. A large body of literature considers the consequences of this stressful experiences on children, partners, and other family members (e.g. Geller et al., 2009; Lopoo & Western, 2005; Porter & King, 2015; Wakefield & Wildeman, 2013). Because the present research focuses on offenders and offending patterns before and after prison, it does not delve into this literature.

and resources to "cure" offenders or reduce their criminogenic needs (Feeley & Simon, 1992). Given the raw number of people experiencing this "new" imprisonment experience, and the substantial barriers to successful reentry that amount from imprisonment's influence on other institutions, research must consider long term effects of this new criminal justice system.

Considering imprisonment as a turning point in the criminal career may offer dividends in this endeavor. To date, few studies situate the imprisonment experience within the life course paradigm, an omission which leads to a less refined and potentially overly simplistic view of the relationship between imprisonment and crime. Studying imprisonment in a life course framework assesses the extent to which imprisonment is associated with change in offending levels or patterns, while remaining cognizant of the fact that there may be groups of individuals who respond either positively or negatively. This nuanced analysis is needed to further our understanding of imprisonment and criminal behavior.

The present work conceptualizes and measures imprisonment as a turning point in the criminal career, seeking to unpack heterogeneity in the relationship between imprisonment and crime utilizing life course principles. Critically assessing paradigmatic life course principles can reveal whether imprisonment functions as a turning point for individuals with different incarceration histories and ages, and may provide insight as to why those patterns emerge. In the analyses, the direction of the turning point is unrestricted, which allows imprisonment to function as either a positive and negative turning point depending on the criminal trajectories that precede and follow a prison term.

2.1. Turning Points

The life course is composed of a series of trajectories[3], or long term behavioral pathways. Within behavioral paths are transitions, or life events and short term changes in roles or social positions that "give [pathways] distinctive form and meaning" (Elder, 1994, p. 5). Pathways can change direction over the life span, indicating a change in the course of development.

A turning point is a life event that has dramatic and lasting impact on an individual's pathway. In his seminal work on life course development, Elder (1985) defined a turning point as a transition which "reshapes the life course" and deflects the existing behavioral pattern. Unlike a transition, a turning point is not simply embedded within a pathway - it is a source of change in the pathway. Other scholars have defined turning points as "specific events or milestones that substantially alter the direction and/or slope of a trajectory" (George, 2009, p. 169) or as a life events that cause more than a ripple in human development and link smooth behavioral patterns (Abbott, 2001).

These definitions are echoed by Sampson and Laub (1993), who introduced the concept of a turning point to criminology. In a criminological context, a turning point is a life event associated with marked changes in offending or involvement in the justice system. Criminological research identifies numerous potential turning points in the criminal career. Marriage and employment are among the most commonly studied

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[3] Though in many instances the terms pathway or pattern are used interchangeably with trajectory, a distinction exists between a conceptual trajectory, which extends an individual's entire life, and an analytic trajectory which is modeled over shorter periods of time (usually due to data restrictions) using sophisticated estimation strategies (e.g. group based trajectory modeling, growth curve modeling, hierarchal linear modeling). For example, an individual has a latent criminal trajectory that includes all instances of criminal behavior over the life course. Portions of that criminal trajectory can be modeled over shorter periods of time, but may contain only observed instances of criminal behavior that are self reported and subject to memory and reporting biases, and/or officially recorded crimes. For the remainder of this document the word trajectory refers to a statistical estimate of a latent behavioral pattern. This should not be confused with the conceptual trajectory, which is referred to as a behavioral pattern or pathway.

turning points, eliciting substantial declines in offending and criminal justice contact (Craig et al., 2014; Laub et al., 1998; McGloin et al., 2011; Sampson & Laub, 1993; Uggen, 2000). Other turning points in the criminal career include (but are not limited to) residential change (Kirk, 2012), military service (Elder, 1986; Sampson & Laub, 1993), education (Blomberg et al., 2012; Walters, 2017), and parenthood (Kreager et al., 2010; Landers et al., 2015; Pyrooz et al., 2017). The turning point literature attempts to understand discontinuity in criminal behavior, provide a refined sense of how and why criminal behavior changes, and offer insight on how to effectively control crime (Laub, 2016). Many studies estimate the "effects" of turning point events on subsequent criminal behavior in partial fulfillment of these goals.

Scholars across disciplines (including criminology) agree on the descriptions of turning points provided above, as well as their theoretical and practical value. Still, a few nuances in the definition and character of turning points are worth noting as they relate to measurement and identification challenges for criminology. First, a turning point is characterized by a change in a behavioral pathway; behavior that unfolds following a turning point is clearly distinct from the preceding pattern. Second, turning points are not randomly distributed or assigned across the population. The processes that generate turning points involve both selection and simultaneity. Individuals with certain characteristics are more likely to get married, join the military, or experience other transitions. These same characteristics may also produce criminal behavior. Selection biases complicate the estimation of turning point "effects" because it is difficult to disentangle pre-existing individual differences and behavior change due to the turning point. Additionally, turning points may have recursive relationships with behavior. For

example, with respect to employment, scholars have identified reciprocal effects of employment on crime and of crime on employment (e.g. Skardhamar & Savolinen, 2014). Bias derived from reciprocal relationships require sophisticated analytic techniques to estimate the "effects" of turning points on criminal behavior.

Third, there is heterogeneity in turning points and in how life events relate to behavior. Turning points can be positive or negative. In some instances, life events may be protective, fostering prosocial, healthy development, whereas in other situations, they may modify or interrupt development in adverse ways. The direction of behavioral change may result from the character of the turning point itself, its duration, the context in which it is experienced, and/or the characteristics of the individual (Elder, 1994; George, 2009; Pickles & Rutter, 1991; Rutter, 1996). Laub and colleagues (1998) demonstrate that not all turning points are created equal, noting for that marriage quality conditions the relationship between marriage and criminal behavior. Even among individuals who experience similar life events, individual level factors or prior behavior may still condition the response to the turning point and the subsequent behavioral change. For example, Uggen's (2000) work on employment as a turning point in the criminal career suggests that the impact of employment depends on the offender's age; reductions in crime were only observed among older offenders.

Historical and cultural context are other sources of heterogeneity in turning point influences. Elder (1986) identified military service as a turning point, benefiting men from disadvantaged homes during the Great Depression. It is unclear whether the same relationship holds true for military service and criminal behavior among this who serve today. Because turning points are embedded with behavioral pathways, they cannot be

separated from the historical time or environmental context in which the individual lives (Elder, 1986, 1994).

Defining turning points as a "specific event or milestone" that alters development (George, 2009) suggests that the event is finite or has clear temporal bounds. In many cases, however, it is difficult to definitively establish these bounds and determine the start and end date of a turning point (Abbott, 2001; Cohen, 2008). For instance, if marriage is a turning point, does behavioral change occur immediately following the wedding even though the couple presumably had a relationship before that date? If a turning point's influences occurs strictly after it is experienced, in the case of marriage, any behavioral change would be measured following the wedding and any change that occurred prior to the wedding may not be captured or may hinder precise estimation of the marriage effect. This ambiguity poses challenges to measuring turning points and estimating their effects because it is unclear when a change in behavior should be observed.

Complicating matters further, Sampson and Laub (1993) note that turning points can have either abrupt or gradual influence on behavior. They may occur spontaneously or from long term investment, influencing both the duration of the turning point itself and the timing when behavioral change can be observed. To highlight, Laub and colleagues (1998) demonstrate that the effect of marriage on crime unfolds in a gradual, cumulative process as the individual invests in a relationship and the bond strengthens. Their work highlights that turning points may have a narrative character that results in a gradual rather than immediate behavioral change (Abbott, 2001; Haveren & Masoaka, 1988). It remains an empirical question whether all turning points have gradual influence on behavior or whether some turning points more abrupt.

Though it is not often stated directly, the definitions of turning points imply that they cause behavioral change. Words like "redirect" or "deflect" suggest that the turning point itself is responsible for the behavioral change observed. Some scholars go as far as saying that establishing a causal relationship is a first order concern in turning point research (Sampson et al., 2006; Wimer et al., 2008). Numerous studies assess the effect of turning points on criminal behavior and shed light on potential endogeneity biases complicating these analyses. A variety of econometric identification strategies and counterfactual designs are utilized to estimate the unbiased causal relationship between proposed turning points and criminal behavior. These methods include matching designs (e.g. King et al., 2007; Melde & Esbensen, 2011), fixed effects regressions (e.g. Apel & Horney, 2017; McGloin et al., 2011), instrumental variable analyses (e.g. Kirk, 2012), inverse probability treatment weighting (e.g. Sampson et al., 2006), and experiments (e.g. Uggen, 2000; Visher et al., 2005), to name a few.

Most of the analytic strategies listed above estimate the direct effect of a proposed turning point on criminal behavior. What remains unclear is whether a turning point has only a direct effect on development and behavior, or whether this effect is indirect. For example, marriage is empirically related to reduced criminal activity, but scholars have explained the marriage effect with a variety of intervening processes, ranging from changes in routine activities, to changes in deviant peer associations, to identity transformations (Giordano et al., 2002; Laub & Sampson, 2003; Warr, 1998). One can question, whether an independent effect of a marriage (or any turning point) should be observed after accounting for potential intervening mechanisms. The answer to this

question likely depends on the turning point in question, but the take away message is clear: turning points may exert direct and/or indirect effects on behavior.

Considering this discussion of turning points, it becomes clear that appropriately and fully measuring turning points and their effects on behavior is a complex task. Still, there are several considerations for researchers to attend to in the study of turning points. First, turning points are embedded within a long-term offending pattern; their identification requires a large amount of data before and after the turning point to establish change in the behavioral path relative to the pre-existing trend (Abbot, 2001). Second, it is crucial to explore heterogeneity in turning points and how they relate to future behavior. Third, turning point take place within a social and historical context, and during particular life stages. Research should acknowledge these contexts as shaping both turning points and their influence on behavior, and limit inference to other contexts or life stages. Fourth, the duration of a turning point should be clearly defined. Fifth, research can explore feedback loops between turning points and behavior. Sixth, outcome measures capturing behavior following a proposed turning point should be a behavioral trajectory and can allow for both gradual and abrupt behavioral change. Seventh, a causal relationship is implied, but intervening mechanisms and indirect relationships should be considered. Admittedly, this is a tall order for research, as data and methodological constraints may prohibit scholars from addressing all of these attributes in a single study. Still it is useful to consider these elements when assessing the turning point literature and identifying candidate life events as potential turning points.

In some ways, research on turning points in criminology falls short of these lofty goals. Though the extant literature contains many rigorous studies identifying the causal

impact of life events, to my knowledge, only one study has estimated a turning point as an intermediate stage in an offending trajectory. Instead, research measures offending only following a life event purported to be a turning point (see Nagin et al., 2008). Other approaches do not capture the progression of behavior prior to a turning point or associate within-person change in offending to the turning point. Many studies also use "static" measures of offending, by employing, for example, binary measures of offending over short follow up periods or measures that capture only the first instance of criminal behavior following a proposed turning point (Bushway et al., 2003; Cohen, 2008; Villettaz et al., 2015). Without a dynamic measure of criminal activity as an outcome, it is not possible to assess the abrupt or gradual nature of turning point effects or whether crime changes relative to the pre-existing pattern. New analytic strategies are needed to address different aspects to turning points. This study offers one approach that addresses some of the limitations of prior work, the dual trajectory approach, but cannot not address all of the measurement considerations raised above. As such, the dual trajectory approach offered here should be viewed as a supplement or complement to existing turning point research, rather than a replacement for existing methodologies.

The search for causal estimates has lead scholars to estimate the exogenous impact of potential turning points on future offending, rather than considering theoretically important endogeneity or how the historical, environmental, and social contexts in which turning points occur shape behavior. What seems to have happened is that evidence of the effect of marriage, or employment, or residential change, on criminal behavior is interpreted as sufficient evidence that a turning point has occurred, when in fact, an empirical relationship alone is not sufficient based on the definition of a turning

point and measurement considerations put forth above. In fact, the necessary and sufficient criteria for determining whether a life event is a turning point are not explicitly stated in most studies, potentially because at present there may not be a disciplinary consensus regarding what those criteria are (or should be). Life course scholars and those studying turning points generally should be explicit regarding what specific criteria is employed in their work, and a conversation regarding the adequacy of these measures may lead to a clearer picture of what a turning point is, and when we have evidence that it occurred in the life course.

Even though original conceptions of turning points do not specify a direction of behavioral change, in criminology, most turning points studies revolve around desistance. Exceptions exist (see Bersani & Chappie, 2007; Brame et al., 2001; Melde & Esbensen, 2011; Nagin et al., 2008), but negative turning points like gang membership, high school drop-out, teen pregnancy, or justice system involvement receive relatively scant attention, making discussions of turning points in the criminal career seem one-sided. With the presumption that the study of turning points contributes to both theoretical knowledge about offending and policy discussions regarding how to address crime (Laub, 2016), considering life events that may have criminogenic impacts is an important but largely missing piece of the conversation. The present research extends the turning point literature by conceptualizing and measuring imprisonment as a turning point in the criminal career, acknowledging that there is theoretical reason to believe that it may operate as either a positive or negative change point.

2.2. Prison and Parole as a Turning Point

One potential turning point in the criminal career is the experience of imprisonment. Imprisonment is a disruptive experience, with influence that spans multiple life domains from employment (Pager, 2003; Pettit & Western, 2004), to family relationships (Siennick et al., 2014; Turney, 2015), to civic engagement (Uggen & Manza, 2006) and has "profound impact on the life course" (Wakefield & Apel, 2016, p. 301). Imprisonment removes an individual from the community and severely restricts autonomy. At some point, the individual returns to the community and faces numerous structural and social barriers to living a crime free life (Mauer & Chesney-Lind, 2004, Travis et al., 2014; Western et al, 2015). In addition to structural barriers faced upon release, in many cases ex-prisoners remain under correctional control during a period of parole supervision. Along with enhanced scrutiny from the justice system, those on parole must abide by the release conditions, frequently meet with parole officers, report for drug testing, and be subject to home searches. In an intuitive sense, it is not difficult to imagine how prison and parole have dramatic impact on development and may serve as a turning point in the criminal career. Narrative accounts corroborate this view of imprisonment as a turning point, although ex-prisoners report that imprisonment fosters motivation to turn away from a life of crime, suggesting a decline marked offending rather than amplification (Edin et al., 2001; Sampson & Laub, 1993; Soyer, 2013). Carefully considering the seven-part definition of a turning point provided previously helps establish this argument that imprisonment could be a turning point in the criminal career.

First, in a literal sense, imprisonment separates a long-term offending pattern into two parts: one before prison and one after prison. While incarcerated, an individual cannot be arrested or offend in a community setting, marking a break in the offending pattern[4]. Second, there is heterogeneity in the experience of imprisonment by state, facility, custody, and post-release supervision levels (Mears et al., 2015; Tahamont & Frisch, forthcoming), and also in how imprisonment relates to subsequent offending (see below for further exploration of this idea). Third, research suggests that the historical time influences the imprisonment experience (Travis et al., 2014), with the present day marking a vastly different environment than in previous decades (Haney, 2002). Additionally, imprisonment clusters in certain communities and demographic groups, suggesting the role of socio-cultural context in generating both imprisonment and crime. Fourth, imprisonment has a clear duration; it occupies a finite space in the life course, with definitive start and end dates marked by entry and exit from the physical institution. Fifth, criminal behavior is a necessary requirement of imprisonment, and imprisonment is empirically linked to offending changes (e.g. Bhati & Piquero, 2008; Cullen et al., 2011; Nieuwbeerta et al., 2009), potentially suggesting bidirectional causality and the presence of feedback loops. Sixth, it is plausible that the imprisonment has an abrupt impact on offending, as evidenced by high rates of recidivism immediately following release (Durose et al., 2014), or it may gradually influence as barriers to reentry accumulate or

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[4] Inmates can commit crimes while in prison. An entire empirical literature investigates inmate misconduct and prison order (for a summary see Steiner et al., 2014). Though many behaviors defined as misconduct involve violations of prison rules rather than the criminal code, some misconduct incidents result in criminal prosecution of incarcerated individuals. Still, there is a clear distinction between misconduct and criminal behavior in the criminological literature; some studies even use misconduct incidents as a predictor of crime in a community setting (e.g. Cochran et al., 2014). The supervision of inmates and opportunities for criminal acts in a prison setting are not equivalent to a community setting, even if they reflect an underlying criminal propensity (Trulson et al., 2011). To remain comparable with other studies, this research excludes misconducts within prisons from the definition of criminal behavior, even if those misconducts violate the criminal code.

relationships are restored. Seventh, imprisonment may be causally related to later offending, although evidence regarding the direction of this effect is mixed (Nagin et al., 2009; Villettaz et al., 2015). The empirical and theoretical justifications for regarding imprisonment as a turning point in the criminal career are explored in detail below.

2.2.1. The imprisonment-crime link

There is no shortage of studies assessing the empirical relationship between imprisonment and crime at the individual level. In 2009, Nagin and colleagues reviewed the literature on prison and crime, and summarized nearly 60 studies of prison's impact on recidivism in addition to 20 studies assessing the impact of time-served on post-release offending. The number of studies has increased in recent years, with scholarly attention focused on mass imprisonment and the collateral consequences of imprisonment (Travis et al., 2014; Villettaz et al., 2015). Unfortunately, this literature paints an unclear picture of the relationship between prison and crime: some studies find that prison is associated with more criminal behavior (e.g. Nieuwbeerta et al., 2009), other studies suggest criminal behavior diminishes (e.g. Bhati & Piquero, 2008), and others find no relationship (e.g. Green & Winik, 2010). Complicating matters further, researchers employ diverse methods and samples, hindering straightforward comparisons across studies.

For instance, Nieuwbeerta and colleagues (2009) use longitudinal data from the Netherlands Criminal Career study to assess the relationship between an individual's first prison stay and subsequent crime. They first estimate pre-prison offending trajectories and sort individuals into trajectory groups. Then, within trajectory groups, the authors compare subsequent offending of individuals who were incarcerated to those who were

convicted but not incarcerated. This matching approach reveals a criminogenic effect of first-time imprisonment; individuals who are incarcerated are more likely to offend within three years after release relative to those who are convicted but not incarcerated.

Using another approach, Bhati and Piquero (2008) find the opposite effect in a sample of parolees in the United States. Using a series of counterfactual hazard models to estimate pre-prison arrest patterns and predict re-arrest outcomes, the authors find that imprisonment both deters and incapacitates offenders, as demonstrated in the reductions in post-release arrests among 96% of the sample (Bhati & Piquero, 2008). Only 4% of released prisoners demonstrated an increase in offending relative to their pre-prison arrest pattern.

Green and Winik (2010) utilize a third strategy to estimate the prison-crime relationship: an instrumental variable approach. The authors leverage exogenous variation in prison sentences generated from randomly assigning criminal cases to judges who vary in their punitive tendencies. Using data from drug cases in the District of Columbia federal courts, the authors find that "randomly generated" imprisonment sentences do not appreciably influence recidivism[5].

Like the research on prison and crime, the collective body of research assessing the effect of parole supervision on criminal behavior present a puzzle. On the one hand, strict supervision of compliance with the law and release decisions may increase the likelihood of detecting criminal offenses and parole violations (Petersilia & Turner, 1993; Solomon et al., 2005). High recidivism rates among parolees corroborate this claim; nearly two-thirds of released prisoners return to prison or are re-arrested within three

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[5] The authors find that the probability of recidivism does increase with the experience of imprisonment, but this result is not statistically significant.

years of release (Beck & Shipely, 1997, Langan & Levin, 2002; Durose et al, 2014). Conversely, parolees tend to fare better under supervision in the community than those released from prison unconditionally. In a study of individuals who max-out of prison in New Jersey, Osterman (2012) finds that a matched sample of parolees recidivated less than those who were released unconditionally. Leveraging a natural experiment in Georgia wherein discretionary parole release was eliminated, Kuziemko (2012) finds that parolees released after a fixed prison term recidivated more than those who were released under the discretionary supervision of the parole board. Taken together, this literature suggests that the relationship between parole release and criminal behavior is similarly unclear.

The above examples represent the most rigorous research on imprisonment and crime. Many regression analyses suggest a correlation between imprisonment and crime, but fall short of providing a credible estimate of the relationship. These examples also illustrate the conflict of findings within this broad literature. Even with rigorous designs the effect of imprisonment on crime remains elusive. In taking stock of this literature, Nagin and colleagues (2009) cautiously conclude that, on average, there is a null or slightly criminogenic effect of imprisonment. The detrimental impact of imprisonment for reoffending was echoed in an updated review of this literature by the Campbell Collaboration (Villettaz et al., 2015), and corroborated by multiple studies documenting high recidivism rates among parolees and ex-inmates (Carson, 2018; Kaeble & Glaze, 2016; Pew, 2011). The authors of these rigorous reviews emphasize the fragility of their conclusions in light of the mixed finding in the literature. By their assessment, there is no

clear picture of how imprisonment relates to post-release criminal behavior, and by extension, whether functions as a positive or negative turning point in the criminal career.

These mixed findings are disconcerting for several reasons. First, this literature largely lacks longitudinal outcomes. Most studies measure post-imprisonment offending within a two-year period following release (Villettaz et al., 2015). Recidivism measures are typically operationalized as binary measures of re-arrest or reconviction (e.g. Green & Winik, 2010), or the time until first re-arrest or reconviction (e.g. Bhati & Piquero, 2008), all of which neglect the patterned nature of post-imprisonment offending. Second, many of these studies do not thoroughly consider heterogeneity in the imprisonment experience. These studies assume that imprisonment is a single, unidimensional treatment and that all offenders respond to imprisonment the same way (a criticism levied by Nagin and colleagues, 2009). This assumption oversimplifies the imprisonment experience. Third, many of these studies are dated, using samples from the 1980s or early 1990s. Given the rapidly changing criminal justice environment, more contemporary analyses may be prudent. With these limitations, many of the important attributes of turning points outlined previously cannot be assessed (specifically heterogeneity, context, abrupt vs. gradual behavioral change, changes in behavioral pathways). Among studies that empirically examine the long term impact of imprisonment on offending (e.g. Samspon & Laub, 1995), what is missing from these studies is a comparison of offending patterns before and after the experience of imprisonment to determine if a change in the overall criminal pathway occurred.

2.2.2. Theoretical rationale

Many scholars have acknowledged that imprisonment affects the life course, and offer theories to explain how imprisonment relates to crime. For example, although the word "turning point" is not used, Moffitt (1993) discusses "snares" in the lives of adolescent-limited offenders that can delay desistance. Once such snare she mentions is the experience of incarceration (Moffitt et al, 1996). Similarly, Sampson and Laub's work acknowledges the potential for incarceration or criminal justice involvement to weaken social bonds and elicit criminal behavior (Laub & Sampson, 1995; Sampson & Laub, 1993). Though these and other studies recognize that prison may alter the life course, theoretical development why imprisonment is a turning point is less developed.

More generally, though many scholars investigate the impact of turning points, few have theorized *why* turning points result in behavioral change or if these influences are specific to the life event under study. Laub and Sampson (2003) is one exception. The authors outline four mechanisms underlying the behavioral change elicited by any turning point: 1) knifing off the past from the present, 2) changes in supervision and social support, 3) altered routine activities, and 4) provision of opportunities for identity change. Reviewing these mechanisms in relation to the imprisonment experience suggests that imprisonment can be a turning point in the criminal career, though the expected direction of behavioral change is unclear.

First, imprisonment may serve to "knife off" the past from the present. "Knifing off" involves separation from previous antisocial influences and viewing criminal behavior as part of the past, rather than an expectation for the future (Maruna & Roy, 2007). Temporary removal from the community and access to in-prison programming

designed to reduce criminogenic tendencies may put an individual in a better position to avoid criminal activity upon release from prison. Parole supervision may also be viewed as a safety net, supporting ex-inmates during the transition to the community. In this way, imprisonment may provide an individual with a fresh start and a way to knife off a criminal past. The success of rehabilitative programs such as in-prison and community based substance abuse treatment (Killias et al., 2009; MacKenzie, 2006), employment training (Cook et al., 2015), in-prison education (Seiter & Kaedela, 2003), and cognitive behavioral therapy (Lipsey et al., 2007) tentatively support this claim.

Conversely, parole supervision is a continuation of correctional control, potentially reminding the individual of the prison experience and past crimes, thus impeding a "fresh start." Most ex-prisoners return to their pre-prison communities, reentering the same contexts that lead to imprisonment (Lynch & Sabol, 2001). Similar contexts may provide opportunities for criminal behavior, or inducements toward old behavior patterns, which may serve as barriers toward "knifing off" criminal pasts. (Kirk, 2012). The post-prison communities receiving returning prisoners are often the least equipped to support reintegration. Lack of jobs, government resources, disorganization, and high criminal justice presence may well obstruct the fresh start that ex-prisoners seek. Prosocial opportunities could also be "knifed off" as a consequence of imprisonment or a criminal record or parole status (Rocuqe et al., 2013). Despite parolee intentions or support provided by parole supervision, difficulty attaining suitable jobs (Pager, 2003; Pettit & Western, 2004) or housing (London & Parker, 2000), and weak family support (Grindstaad et al., 2001; Turney, 2015) may hinder attempts to knife off the past, and instead sustain or even amplify criminal behavior.

Second, imprisonment may prompt changes in supervision, social support, and social capital. Control theory argues that criminal behavior increases as an individual's bond to conventional society weakens (Hirschi, 1969). Much literature on collateral consequences demonstrates that imprisonment degrades human capital and social bonds (Rocque et al., 2013; Travis et al., 2014). As one example, ex-prisoners and parolees are less likely to attain employment and if they do secure a job, make lower wages than the general population (Pager, 2003; Pettit & Western, 2004; Western, 2006). With respect to social support, parolees have weak family ties—they are less likely to be married and more likely to be divorced than the general population (Petersilia, 2003). Many parolees report strained family relationships as a prominent challenge upon release from prison (Travis et al., 2014; Western et al., 2015). The literature on prison visitation also suggests that social support from outside the prison is limited (Comfort, 2008; Hickert et al., 2017; Tahamont, 2013). Restrictive communication and visitation policies, the remoteness of prison facilities, financial hardship of partners and families, and the overall emotional strain that imprisonment places on family and friends could reduce the volume and quality of social support received in prison.

Even if prosocial support exists during incarceration or in the community post-release, the prison experience may alter inmates psychologically such that they are less likely to form or maintain strong attachments upon release. In the process of adapting to the prison environment many inmates develop tendencies toward social withdrawal, emotional repression, and distrust of others (Adams, 1996; Haney, 2002). Though potentially necessary to coping with the deprivations and dangers of the prison setting, these traits are not conducive to strong inter-personal relationships and may obstruct

others' attempts to provide social support following prison. Without emotional reciprocity, attachments may weaken or dissolve.

Where prosocial support may be limited in prison, antisocial influences may be more readily available in a prison setting. Criminal attitudes and peer associations are prevalent in prisons, and more common as custody level increases or when inmates are celled with more sophisticated criminals (Harris et al., 2018; Lerman, 2009). Nguyen and colleagues (2017) also found that behind bars, individuals accrue criminal capital, developing skills and contacts that promote illegal behavior upon release. From the perspective of learning theories (Akers, 1998; Sutherland, 1939), limited prosocial and pervasive antisocial influences in prison create an environment for criminal socialization. Criminal attitudes and behavior may be both learned and/or reinforced in prison, resulting in relatively more crime upon release. If this is true, then prison may serve as a negative rather than a positive turning point.

Furthermore, parole supervision is intended to provide support and supervision to individuals in the transition from prison to the community (Petersilia, 2003; Travis, 2005). These stated goals of parole directly align with Laub & Sampson's (2003) second mechanism. Community supervision is often viewed as a vehicle to provide ex-prisoners with services in the community. Many release conditions require parolees to attend drug treatment, anger management, or another service to reduce criminogenic needs. In Pennsylvania (the current research site), prior to release from prison inmates develop a "home plan" or an individualized guide to successful community reentry. In the process of completing this plan, the inmate identifies jobs, housing options, treatment providers, and family in the community with his or her parole officer. The parole board must

approve the home plan prior to an inmate's release (PADOC, 2018). In both principle and practice parole supervision can increase an individual's social support.

Direct supervision is also greater for individuals on parole relative to those not on parole. Parole officers have the authority to sanction parolees, conduct searches of their homes and vehicles, and administer drug tests. They also possess arrest and sanctioning powers including the ability to give citations, commit a parolee to a violation center or local jail, increase or decrease the conditions of parole release, and revoking parole supervision. Formal social control may reduce criminal behavior among parolees, either through deterrence or social bonds (Beccaria, 1784; Hirschi, 1969).

Research suggests that although the goals of parole release are two-fold, few resources are allocated to the objective treatment and social support (Haney, 2002). Feeley & Simon (1992) refer to a "new penology" wherein correctional priorities shifted from risk reduction and rehabilitation toward risk management and punitive practices. With the fall of the rehabilitative ideal in the mid 1970's (MacKenzie, 2001), the majority of correctional resources shifted from treatment programs to catching and punishing rule violators both in prison and on parole. Bonta and colleagues (2008) find evidence to support this narrative, demonstrating that community corrections officers are more focused on monitoring parolees than providing services or support. If the support function of parole supervision is underfunded and underemphasized relative to the enforcement function, parole violations and revocations are detected more frequently, increasing the likelihood of observing imprisonment as a negative turning point, rather than a positive turning point.

Third, imprisonment may alter routine activities. Prison is a "total institution" that is highly structured and controlled (Goffman, 1958). Inmate routines are dictated by prison staff, their movement is restricted or monitored, and schedules are strictly regimented with little variation on a daily basis. Inmates have so little control over their routines that they may lose the capacity to make their own decisions and shy away from personal control (Adams, 1996; Haney, 2002). Upon release from prison, however, routines shift and ex-inmates are expected to organize their own schedules, including any work or family obligations. Because roughly 85% of inmates are released onto some form of parole supervision (Kaeble & Bonczar, 2015), returning prisoners must also juggle the demands of the justice system. Parole supervision can require parolees to remain in certain geographic areas, check in with parole officers at scheduled intervals, report for random drug testing, and prohibit association with criminal peers (Pennsylvania Board of Probation & Parole, 2013; Petersilia, 2003; Travis, 2005). As such, parole supervision could ease the transition from prison to the community by providing some predetermined structure or reducing the amount of unstructured time and criminal opportunities in the community. This would suggest that imprisonment may serve as a positive turning point, reducing post-release offending. However, many ex-prisoners feel may distressed by the variety of demands entailed by community life and the routines of parole supervision (Haney, 2002). Some offenders report that they prefer incarceration to community sanctions because community supervision is too restrictive (Wood & May, 2003). Discontent with parole officers or the conditions of release may lead to defiance and amplified criminal offending among parolees (Sherman, 1993). Spatial contagion research also suggests that many parolees return to the same areas as one another, which

are often characterized by disadvantage and high crime rates (Morenoff & Harding, 2014). Without stable employment, unstructured time in these settings may increase criminal behavior (Osgood et al., 1996). Returning to high crime communities with other similarly situated individuals may increase criminal behavior among ex-prisoners, suggesting that prison can serve a negative turning point.

Finally, imprisonment may serve to alter criminal identities. Many programs in prison are designed to combat criminal thinking and alter how an inmate views him or herself. Cognitive behavioral therapy serves as one successful example of a program that reduces post-release offending (Lipsey et al., 2007). Narrative accounts of imprisonment also suggest that the imprisonment experience fosters desire refrain from offending (Laub & Sampson, 2003; Soyer, 2013). Identity change during imprisonment may also result from a "crystallization of discontent" wherein individuals recognize that their previous choices led to prison, inspiring desire to change their behavior moving forward (Paternoster & Bushway, 2009). Prosocial identity change or desire to desist from crime may also be supported by parole supervision, which provides services to returning prisoners and can facilitate reintegration into community networks. As such it is possible that imprisonment serves as a positive turning point by fostering prosocial identities.

Labeling theory provides an alternative perspective. Criminal sanctions signal to offenders that society disapproves of their behavior, which can engrain criminal identities (Becker; 1963; Lemert, 1951). Asencio and Burke (2011) find support for this perspective, noting that prisoners more strongly identify with criminal identities when they believe other people view them as criminals because they are incarcerated. Their work highlights the importance of reflective appraisals from significant others (e.g.

spouses or family) in the construction of the criminal identity (Heimer & Matsueda, 1994) and the role of imprisonment in that process. Kolstad's (1996) interviews with prisoners reveal that feelings of being "deviant" and denounced by society are strong prison. Prisoners may also adopt new identities when socialized to the prison culture. Such identity change may be a necessary defense mechanisms in a prison environment (Adams, 1996). Parole supervision may perpetuate these identities or the stigmatization that occurs from the prison experience by constantly reminding ex-prisoners of their criminal status. Discretionary parole release signals to offenders that they are "low risk enough" for release, but not "safe enough" to reside in the community without supervision. Regular meetings with parole officers may reinforce the criminal label, increasing the likelihood of internalization and secondary deviance (Becker, 1963; Lemert, 1951). It is therefore possible that identity changes associated with imprisonment may also elicit discontinuities in offending consistent with a negative turning point.

The four mechanisms outlined by Laub and Sampson (2003) present a puzzle. Unlike other turning points, it is unclear whether imprisonment will serve to increase or decrease post-release offending. Clearly there are competing theoretical hypotheses regarding the relationship between imprisonment and crime, and the empirical literature does not provide much clarification. It is also possible that diverse processes are at play in different subpopulations. Considering imprisonment from a life course perspective provides some guidance toward reconciling this seemingly contradictory evidence.

2.2.3. Why study imprisonment through the lens of the life course paradigm?

The life course paradigm is governed by four principles (Elder, 1994). First, the historical, cultural, social, and environmental contexts in which development is

embedded shape the life course. The salience of life events and responses to life events depend on historical time and social or geographic location. Second, the timing of life events can determine their impact. Third, individuals are linked to other people, organizations, and institutions. Elder (1994, p. 6) writes that "human lives are typically embedded within social relationships …the principle of linked lives refers to the interaction between the individual's social worlds over the life span—family, friends, and coworkers… change is experienced by individuals through such worlds." Not only are individuals interdependent, but life events are also interdependent. Experiences in one developmental domain often relate to others (e.g. marriage and parenthood), and life events can exert join influence on individuals (Elder, 1998; Sampson & Laub, 1993) Fourth, individuals play in active role in their own development, making choices that have consequences for the future.

In addition to considering these four principles, in criminology, a central part of life course research involves describing the divergent paths that lead into and out of criminal behavior. The life course paradigm recognizes that there is variability among offenders and the life experiences that influence developmental paths. As such, there is no expectation of a single relationship between imprisonment and crime, but rather there can be many that depend on who experiences imprisonment, when, and in what context. Appraising heterogeneity involves unpacking average treatment effects and allowing for the possibility that some individuals may vary with regard to whether imprisonment is a positive or a negative turning point. Investigating whether such heterogeneity exists would shed insight on the mixed findings in the extant literature. If some individuals are deterred by imprisonment while others are stigmatized or restricted from human capital,

average estimates would simultaneously mask this variation and bias the relationship toward zero.

The life course paradigm offers other dividends to the study of prison and crime. Laub (2016) draws a parallel between life course research and watching a movie. Absent consideration of life course principles, research only captures a snapshot (or maybe a single video) of the relationship between imprisonment and crime, without knowledge of what happens before and after that moment. What is missing from the study of imprisonment is the progression of behavior leading up to and following imprisonment, and an appraisal of how the time period and behavior in question fits within the larger story of an individual's life and developmental history. Imprisonment does not occur within a vacuum. Prior to imprisonment, an individual may or may not be embedded within social networks, the educational system, the labor force, or the community writ large. The extent to which imprisonment disrupts criminal behavior likely depends on which ties were severed, and which (if any) ties the inmate can restore upon release. Failure to account for these nuances potentially leads to oversimplification and misspecification of the relationship between imprisonment and crime.

A life course approach to the study of imprisonment also incorporates longitudinal measures of criminal behavior that capture the progressions and patterns of offending both before and after prison. The majority of corrections research utilizes short term follow up periods, often shorter than two-years post-release (Villettaz et al., 2015). To be fair, some argue that the majority of post-release offending occurs within this short window immediately upon release (Gottfredson et al., 1997). Even if individuals are re-incarcerated quickly, they return to the community, and capturing this cycle or changes to

this pattern could be an important part of understanding post-prison offending and prisons effects. Still, rather than capturing the patterned nature of crime following imprisonment, many studies instead use binary measures of post-release offending or measure the time until first offense (Maltz, 1984; Schmidt & Witte, 1988). Though useful in understanding what post-release offending looks like, these practices do not capture *how* criminal behavior unfolds following imprisonment or how post-prison offending compares to a pre-prison trend. Without this comparison, a turning point cannot be inferred.

Imprisonment is a semi-exogenous life event. Its influence on offending is neither random nor completely deterministic. Imprisonment co-occurs with poverty, unemployment, weak relationships, and neighborhood disadvantage, which makes disentangling its effects on crime quite challenging (Nagin et al., 2009; Travis et al., 2014). This endogeneity aligns with life course principles of context and interdependence of life events. Though much research on imprisonment and crime seeks to remove this endogeneity in favor of precise causal estimation, making these endogenous aspects of imprisonment and offending the focus of research may reveal something new about this relationship.

A life course approach to the study of imprisonment involves an awareness of both historical and environmental context. With profound changes to the correctional system in the last forty years, the imprisonment experience today barely resembles systems of the past. An exploration of the historical progression of imprisonment in the United States is beyond the scope of the present work, but describing how imprisonment relates to crime in the present era is one step toward understanding this new context. It is imperative to evaluate this new correctional system in terms of its goals of crime

prevention and control, without assuming prior evaluations are still relevant. Additionally, imprisonment and crime now cluster in certain neighborhoods, families, and individuals. Understanding how these contexts generate offending and imprisonment, as well as how they structure the imprisonment experience provides a more nuanced understanding of this relationship, which can contribute to theory development and policy change.

The primary goal of this research is to integrate life course principles and the study of imprisonment by documenting the circumstances under which imprisonment is a turning point in the criminal career. Suggesting integration between the studies of imprisonment and life course criminology is not to say that scholars have not considered the long-term impacts of imprisonment or studied prison through the lens of the life course. As one example, Laub & Sampson (1995) assessed how the number of days incarcerated as a juvenile relates to criminal behavior in adulthood. They found that though there is no direct effect of incarceration during youth, incarceration decreases job stability, which increases adult crime. In life history interviews with a portion of the same sample, many men reported that reform school or detention changed their lives, leading the authors to conclude that incarceration can be a formative experience. The literature examining the effect of incarceration on crime supports this claim. Many studies also demonstrate how imprisonment other aspects of the life course, including employment and earnings (e.g., Loeffler, 2013, Pettit & Western, 2004), education (e.g., Pettit & Western, 2010), and family relationships (e.g., Apel et al., 2010; Turney, 2015).

In addition to empirical evidence linking incarceration to crime and over time or other developmental phenomena, Moffitt (1993) posits that incarceration can delay

desistance, ensnaring delinquent youth on a criminal pathway and blocking off prosocial opportunities. This process is consistent with the Sampson & Laub (1993)'s claims that imprisonment can alter the life course or the course of offending. Building off these prior works and theoretical orientations, this dissertation seeks to integrate the study of the life course and the study of corrections in a different way, by conceptualizing and providing a way to measure imprisonment as a turning point in the criminal career. According to the definition of turning points provided in Section 2.1, only with a relative comparison of offending before and after an event can a change in a pathway be detected, and a turning point inferred. Though prior work has indicated that of prison and parole may influence offending, what's missing from these studies and conceptualizations is a consideration and assessment of the extent to which there is discontinuity in offending before and after the imprisonment experience. The empirical and theoretical evidence provided above suggests that imprisonment qualifies as a turning point by causing changes in crime, but also suggests that direction of change is unknown and may vary across subpopulations. Given the multidimensional nature of imprisonment and the diverse populations who experience it, there is probably no "universal" imprisonment-crime relationship. As such, the first hypothesis of this research is that imprisonment serves as a turning point in the criminal career, but the direction of behavioral change is conditioned by a variety of sources. These sources of heterogeneity are thoroughly explored in the sections to follow.

Hypothesis 1: Imprisonment serves as a turning point in the criminal career, resulting in either positive or negative changes in crime.

Hypothesis 1A: The direction of behavioral change will vary across subgroups.

2.3. Heterogeneity in the relationship between imprisonment and offending

If imprisonment serves as a turning point in the criminal career, heterogeneity may exist on two levels: 1) variation in the imprisonment experience itself, both in terms of quality and duration (treatment heterogeneity), and 2) variation in the individual response to imprisonment (treatment effect heterogeneity) (Nguyen & Loughran, 2018). Though the present work focuses on identifying heterogeneity in how individuals respond to imprisonment, there is reason to also suspect that there is meaningful variation in the imprisonment experience. The United States is home to 56 correctional systems: one for each state, U.S. territory[6], and the federal government. Different goals, budgets, and policies regulate each system, resulting in vastly diverse conditions of confinement and release across the country (Mears et al., 2015). Even within the same state, the experience of imprisonment is structured by facility security level and inmate custody level (Tahamont & Frisch, forthcoming). For example, prison facilities of differing security levels can look very different in terms of physical structure and organization. The number of correctional staff, security features, and housing arrangements vary with prison security level, and have implications for inmate autonomy and lifestyle while incarcerated. Because more secure prisons are typically located in remote areas, they may be inaccessible to potential visitors. Even the size of a correctional system can determine how inmates experience imprisonment in that the ratio of inmates to facilities can impact overcrowding and available resources for rehabilitation.

In terms of inmate custody, higher levels involve less autonomy, distinct programing, different housing arrangements, confinement with more sophisticated

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[6] U.S. territories with autonomous correctional systems include Puerto Rico, Guam, Northern Marianas, American Samoa, and the U.S. Virgin Islands (Glaze & Herberman, 2013).

criminals, and limited visitation, all of which can relate to post-release offending (Berk et al., 2003; Berk & de Leeuw, 1999; Chen & Shapiro, 2007, Tahamont, working paper; Tahamont & Frisch, forthcoming). In short, inmate custody level determines almost every aspect of inmate life. For example, maximum custody is the most restrictive classification for an inmate. Regardless of the state, a maximum custody inmate is almost always housed in a single or double bed cell and is restricted to that cell for the majority of the day (sometimes for 23 hours). When leaving their cells, maximum custody inmates are often escorted by armed guards or in shackles. Because they are deemed dangerous to themselves or others, maximum custody inmates may also be restricted from participating in educational or other rehabilitative programming, or prohibited from receiving visitors. By contrast, minimum custody inmates may be housed in a dormitory with multiple other inmates, have freedom to roam the facility and grounds within the secure perimeter, and are rarely restricted from work assignments or programming (Tahamont & Frisch, forthcoming).

The parole experience is similarly heterogeneous. Even among discretionary parole releases, inmates may be supervised at different levels which dictate the amount of autonomy and constraints imposed by the justice system (Petersilia, 2003; Solomon et al., 2005). For example, in Pennsylvania, inmates supervised on minimum supervision are required to report to a parole office once every three months and have less frequent drug tests or random home searches. By contrast, parolees on maximum supervision must report to parole officers at least monthly (sometimes even twice per month) and typically have more conditions of release to abide by. These conditions can include frequent drug

tests, geographic restrictions, participation and completion of treatment, counseling, or sustaining employment (Pennsylvania Board of Probation and Parole, 2014).

Further, whether inmates are released to a halfway house can drastically alter the imprisonment-reentry experience. Halfway houses are intended to ease the transition to the community by providing housing, meals, and supervision to releasees. Halfway houses offer resources for ex-prisoners to obtain jobs or seek treatment in the community. They also conduct drug tests, impose curfews, and limit visitation for residents. Life in a halfway house is more structured and controlled than living in the community following prison. The alternative for most other parolees it to return to their pre-prison communities, many of which are low income, high crime, and resource deficient (Lynch & Sabol, 2001; Travis et al., 2014). Although this may seem like a supportive, prosocial environment, research indicates that halfway houses are associated with greater recidivism than other forms of release (Latessa & Loewenkamp, 2002).

Parole officer orientations and the character of parolee-parole officer relationships serve as two final sources of heterogeneity in the imprisonment experience (Blasko et al., 2015; Vidal et al., 2013). Some parole officers view their job as providing support to vulnerable populations. Their approach to parole supervision is rehabilitative in nature and they seek to help returning prisoners succeed in the community. Other parole officers are more punitive and distrusting of parolees. Their primary goal may be to catch and re-incarcerate rule breakers (Whitehead & Lindquist, 1992). Clearly these two parole officer orientations could create vastly different parole experiences and/or relationships between parolee and parole officer. The former may offer social support while the latter is marked by distrust, adversary, and penalty.

In addition to variation in the imprisonment experience, responses to imprisonment may depend on individual traits or prior experiences – that is, there may be treatment effect heterogeneity. For example, first-time prisoners may respond differently to the experience of imprisonment than those who have been incarcerated before. Adapting to the prison environment takes time; individuals must be socialized to the inmate code, learn and accept their new roles as inmates, and adjust to a routinized schedule in which they have little to no choice. Those with prior history of imprisonment would be familiar with this environment, and therefore know what to expect. As such, the prison experience may be less traumatic or profound for repeat prisoners and changes to the inmate and subsequent behavior may be less drastic than for first-time prisoners. This argument is detailed in Section 2.3.1.

The potential for both treatment heterogeneity in the imprisonment experience and treatment effect heterogeneity in how imprisonment relates to criminal behavior, suggests that studying prison and crime is not a simple task. It is clear that there are complexities and contingencies that need to be accounted for to fully understand the nuances of the imprisonment-crime link. Though both treatment heterogeneity and treatment effect heterogeneity are equally important to a full understanding how imprisonment relates to crime, I focus solely on treatment effect heterogeneity in this work. The life course perspective suggests two dimensions of turning points as sources of treatment effect heterogeneity: repeated exposure (and by extension cumulative disadvantage in life events) and timing (Elder, 1994). To explore these life course principles, I consider how imprisonment functions as either positive or negative turning

points in the criminal career for individuals with varying imprisonment histories and of different ages.

2.3.1. Treatment Effect Heterogeneity: Number of Prior Imprisonment Experiences

The criminal justice system in the United States has been described as a "revolving door" (Pew, 2011) because arrest or incarceration at one point in time greatly enhances the risk of future criminal justice involvement (Farrington, 1997; Johnson et al., 2004; Sampson & Laub, 1993). In many cases, individuals cycle in and out of correctional supervision, whether in prison, jail, or on supervised release. Habitual offender laws (including three strikes laws) and strict parole policies enacted in the 1990's contributed to imprisonment's "revolving door" by ensuring that many individuals experience imprisonment multiple times.

Some scholars argue that the impacts of criminal justice sanctions accumulate across the life course in a process referred to as "cumulative disadvantage" (Sampson & Laub, 1997). For example, Sampson and Laub (1997) recognize that involvement with the justice system "mortgages the future" by restricting prosocial opportunities later in life, increasing the likelihood of criminal behavior and cementing the individual on a criminal path. Moffitt (1993) makes a similar argument, stating that some adolescent-limited offenders encounter "snares" that delay desistance by degrading social capital or labeling individuals as criminals. Snares can include teenage pregnancy, drug addiction, arrest, or incarceration. With respect to accumulation with turning points, Elder notes that transitions or turning points "can have enduring consequences by affecting subsequent transitions…They do so, in part, through behavioral consequences set in motion 'cumulating advantages and disadvantages'" (Elder, 1998, p. 7). The logic behind these

and similar arguments is that criminal behavior is maintained through state dependent processes. Responses to criminal behavior reinforce similar behavior in the future and/or restrict opportunities to refrain from offending. Attempts to control delinquent and antisocial behavior bring consequences that build up over time, and increase rather than decrease the chances of subsequent criminal activity.

If an individual is imprisoned more than once, the consequences of being imprisoned may accumulate in a process consistent with cumulative disadvantage by inhibiting the development of prosocial capital. Removal from a community setting interrupts employment, education, housing, and treatment services. With multiple disruptions and potentially long periods of absence, the likelihood than an individual maintains a job, or receives favorable recommendation for another job, seems low (Pager, 2003). Inability to pay rent while incarcerated or on parole may also result in the loss of a residence or difficulty obtaining new housing due to poor standing (London & Parker, 2000). In terms of family relationships, both qualitative and quantitative research demonstrate the emotional, financial, and psychological strain placed on the partners and families of imprisoned individuals, both during the time of confinement and upon release (Comfort, 2008; Grindstaad et al., 2001; Turney, 2015). Prolonged stress on these relationships resulting from multiple prison stays may weaken social support over time or prompt relationship dissolution (Apel et al., 2010). A single prison stay imposes these strains on inmates and their families, but it is possible that the consequences accumulate or become more severe when they are experienced again and again. To be clear, repeated imprisonment is not a direct measure of cumulative disadvantage. Insofar as the consequences of imprisonment relate to criminal behavior, it is possible that the impact of

imprisonment accumulates over time in a process that is consistent with but not equivalent to cumulative disadvantage.

Repeated imprisonments have another consequence: individuals may become reliant on the routines of the prison or parole system such that they cannot function in society without a pre-determined daily structure. Haney (2002) argues that "prolonged adaptation to the deprivations and frustrations of life inside prison carries a psychological cost," which includes social withdrawal, paranoia, apathy, and lack of personal control (p. 1). More time out of the community entails more dependence on the institution; inmates may become indifferent to their responsibilities or unable to juggle their various obligations upon release. Regaining autonomy and responsibility upon release can serve as a stressor for returning prisoners and this stress may be greater as time out of the community increases, or is intermittent. Parole supervision may also increase if there is evidence of prior parole failure (Petersilia, 2003). Stricter monitoring in the community may deter crime, and/or ease this stressful transition by providing structure to returning prisoners. But more supervision also increases the capacity of the criminal justice system to detect violations and impose sanctions (which may be inferred as increased offending).

In addition to more restrictive parole supervision, the prison experience is also markedly different for individuals returning to the system. In most cases, sentence length increases as a function of prior imprisonments (Ulmer et al., 2014; Welch & Spohn, 1987). Returning inmates may stay in prison longer due to sentencing enhancements. In virtually all prison systems, prior imprisonments increase inmate custody levels. Higher custody levels involve greater restrictions to autonomy and differential access to programming, which are empirically associated with increased criminal behavior

(Tahamont & Frisch, forthcoming). Higher custody levels also entail socialization with more sophisticated criminals, which may engender or reinforce criminal thinking or attitudes, and ultimately enhance recidivism (Harris et al., 2018; Lerman, 2009). Per the principles of operant conditioning, intermittent reinforcement of attitudes and values results in strong associations and greater influence on behavior (Skinner, 1953).

Higher custody levels, restricted program eligibility, intermittent reinforcement of criminal attitudes, and longer sentences, collectively suggest that repeated imprisonments can generate of criminal capital. Additional stays in prison involve confinement with new inmates, often in new units or new facilities, which may increase not only the volume of criminal capital, but the diversity of criminal capital. Criminal capital may translate into more opportunities for criminal behavior upon release (Bayer et al., 2009; Morselli & Tremblay, 2004; Nguyen et al., 2017), marking amplification in offending and a negative turning point.

Based on the theoretical and empirical evidence, it seems likely that the consequences of imprisonment accumulate with repeated incarcerations. A single removal from the community and the accompanying disruptions to employment, education, relationships, and housing may be detrimental, but the likelihood of salvaging those bonds may decrease if interruptions persist. Additionally, the experience of imprisonment may diminish inmates' personal control and capacity to live on his or her own. Repeated imprisonment is associated with higher custody level and socialization with criminal peers, both of which may result in the accumulation of criminal capital. Upon release, stricter parole supervision enhances the capacity of the justice system to detect and punish criminal behavior, increasing the change that post-prison offenses are

officially recorded. As such, it is hypothesized individuals with prior imprisonment history more frequently experience prison as a negative turning point than first-time prisoners.

Hypothesis 2A: Individuals with prior imprisonments are more likely to experience prison as a negative turning point than are first-time prisoners.

Though it is plausible that the impact of imprisonment accumulates with repeated exposure, it is also possible that the first time an individual goes to prison is the most dramatic and impactful for behavior. Prior work acknowledges both the salience of new experiences in the life course and the adjustments to one's daily life that accompany many turning points. In a study of parenthood, Pyrooz and colleagues (2017) demonstrate that the transition to parenthood (i.e. birth of the first child) has the most profound influence on male and female gang members. Birth of the first child is associated with sustained offending reductions for females and temporary offending reductions for males, whereas the birth of the second child has only temporary impact on females' and no effect on males' offending. The authors claimed that because first-time parenthood involves identity change, adjustments to daily routines, and the greatest financial burden, the impact of parenthood on crime is concentrated at the first occurrence (Pyrooz et al., 2017).

It is also plausible that first-time imprisonment has the most profound influence on the individual, and is therefore the relevant turning point. After all, the consequences of a criminal record or removal from the community occur with the first imprisonment. Whether it is felon status, job loss, school dropout, or weakened family relationships, these bonds are likely to break when an individual is first imprisoned.

Imprisonment may also be most distressing during the first stay. Inmates must suddenly cope with having no control over their routines, they are barred from contact with their friends and family, and must be socialized to a prison culture. Though returning prisoners may be re-socialized, the first time in a new environment is presumably when the majority of socialization and changes to the individual occur (Louis, 1980). First-time inmates are introduced to an entirely unique social structure, social norms, and roles, which may yield changes in attitudes, beliefs, or even identity (Clemmer, 1950; Lerman, 2009; Sykes, 1958). According to the deprivation hypothesis, exposure to the prison environment and the "pains of imprisonment" necessitates socialization into the prison culture as a coping mechanism (Jiang & Fisher-Giordano, 2002; Rocheleau, 2013; Sykes, 1958). To the extent that attitudinal change and prisoner-role taking increases criminal behavior (Akers, 1999; Heimer & Matsueda, 1994), this change is likely to be observed after the first imprisonment when the majority of socialization occurs.

In addition to (or maybe because of) this socialization process, new prisoners have the greatest difficulty adjusting to the prison environment (Wolfgang, 1961). Reports of anxiety, fear, and paranoia are less common among repeat prisoners, suggesting that first-time imprisonment is most traumatic (Jones & Schmidt, 2000; Souza & Dhami, 2010). First-time prisoners and parolees may also hold unrealistic expectations regarding the prison experience. Relative to repeat prisoners, first-timers report being less satisfied with the prison experience and report that it is more stressful than they anticipated (Goodstein et al., 1984; Souza & Dhami, 2010). Similarly, Bucklen and Zajac (2009) find that parolees are more likely to fail when they hold unrealistic expectations

about supervision and reentry. Fear, negative emotions, and unmet expectations constitute enhanced strain during first imprisonment, which may result in more post-release offending (Agnew, 1992; Listwan et al., 2013). Taken together, this evidence suggests that changes to criminal behavior are concentrated at the first imprisonment experience, which means that first-time imprisonment is likely to serve as a negative turning point in the criminal career.

On the contrary, recidivism studies suggest that first-time prisoners are less likely to recidivate than those reentering the community with lengthier incarceration histories (Dhami et al., 2006; Kaeble et al., 2015). One explanation for this finding is that first time imprisonment "scares individuals straight" and serves as a salient deterrent (Beccaria, 1764). Exposure to such a harsh environment and the accompanying fear and anxiety may be profound enough to discourage future crime. Surveys suggest that first-time prisoners are also more likely to seek educational and rehabilitative programming in prison and value the opportunity to improve themselves (Souza & Dhami, 2010). Using prison as a time to better oneself may reduce criminogenic needs and subsequent offending. In light of contradictory theoretical claims, a two-tailed hypothesis regarding first-time imprisonment is needed.

Hypothesis 2B: Imprisonment is more likely to serve as a turning point among first timers than repeat prisoners.

2.3.2. Treatment Effect Heterogeneity: Age at the Time of Imprisonment

Elder (1994) contends that the timing of a life event, or the developmental stage in which it occurs. determines how that event is experienced by an individual. Age is a proxy for biological, psychological, and social development (Cooney & Hogan, 1991; Falletta & Dannefer, 2014). Because society attaches role expectations and time tables to

certain life stages, a behavior may be appropriate and praised in at one life stage, but denounced in another. Parenthood is a classic example of the importance of timing; becoming a parent at age 30 has strikingly different implications than becoming a parent at age 14 (Hagan & Palloni, 1990). As a teenager, parenthood is often unplanned and part of a larger repertoire of risky behavior (Woodward et al., 2001). Teenage mothers may be less informed and less able to afford proper pre-natal care than are older women, which may result in health complications for the mother and child (Irvine et al., 1997). By contrast, parenthood at age 30 is more likely to occur among married couples with greater financial stability. Adult women are less likely to miss school to accommodate the demands of pregnancy and those in the labor force may take maternity leave to avoid substantial interruptions in work and earnings. Like parenthood, the timing of imprisonment may dictate how it is experienced by the individual. The extent to which imprisonment serves as a turning point (and in which direction) likely depends on when it occurs in the life course.

The prison environment is stressful for all inmates, but younger individuals may be less likely to possess the faculties necessary for coping with the stresses of the prison environment. These stresses can include (but are not limited to) lack of autonomy, isolation from family and friends, lack of security and safety, and in some cases, sensory deprivation (Clemmer, 1960; Haney, 2003; Sykes, 1958). As a result, difficulty adjusting to the prison environment is more common among young inmates. Younger inmates more likely to engage in misconduct (Kuanliang & Sorensen, 2008; Steiner et al., 2014), a classic sign of maladjustment, and more frequently report feeling scared and anxious in correctional settings (MacKenzie, 1987). Maladjustment and misconduct in a prison

setting are associated with greater post-release offending (Cochran et al., 2014), suggesting that the trauma associated with imprisonment has implications for subsequent criminal behavior. If maladjustment is more likely among younger adults, imprisonment may more likely serve as a negative turning point for this group.

The prison environment is a "total institution" which isolates an individual from the community and subjects him or her to a highly structured and controlled environment (Goffman, 1961). Inmates are immediately and fully immersed in an environment that lacks autonomy. As part of an adaptation process, inmates can become so reliant on external sources to make decisions that they grow incapable of exercising autonomy or internal control (Haney, 2002). If imprisonment is experienced prior to developing the capacity for autonomous decision making and behavioral regulation (e.g. earlier in the life course), it is possible that individuals fail to develop these qualities all together. Such interruption in cognitive, emotional, behavioral development is problematic as an inmate reenters society following a prison term. Inability to control behavior may result in crime or parole violations. Thus, experiencing imprisonment at a younger age, or particularly during more formative times of cognitive development (e.g. early 20's), may serve to increase post-release criminal behavior.

Age also reflects membership in different social groups and may determine one's source of identity (Shover, 1996). Children commonly identify with family and school roles most prominently, while adolescents identify with peers. As adults, individual take on multiple identities stemming from, for example, work (e.g. plumber, salesman) or family (e.g. wife, father). Identity formation typically solidifies during late adolescence and early adulthood (Arnett, 2000). If individuals are imprisoned or on parole during this

formative time, they may adopt a prisoner or criminal identity (Heimer & Matsueda, 1994). Additionally, if the imprisonment experience occurs prior to adopting other pro-social identities (like father or salesman), then it may be more likely to become a "master status" and dictate criminal behavior moving forward (Becker, 1963; Lemert, 1951). Among younger individuals, this identity master status is more likely to be reinforced in the community, because they are more likely to socialize with deviant peers (Warr, 1998; Warr, 2002).

Not only can criminal peers support criminal identification, they may also provide criminal opportunities or reinforce criminal attitudes (Osgood et al., 1996; Sutherland, 1939; Warr, 2002). Because individuals place greater importance on peer relations in early adulthood, it is possible that younger parolees are more susceptible to "prison peer effects". The likelihood of socializing with criminal peers declines with age (Warr, 1998), meaning that upon release, younger adults are more likely to socialize with other criminals upon release. Both of these processes may increase post-prison criminal behavior.

Opportunities to acquire social and financial capital are also age-graded. Typically, opportunities to form social bonds rise in early adulthood, fluctuate slightly, and then decline with age (Elder & Rockwell, 1976; Falletta & Dannefer, 2014; Stettersen & Mayer, 1997). Finishing school, starting a stable job, marriage, and parenthood tend to cluster around the same time in the life course, known as the transition to adulthood or emerging adulthood (between ages 18-25) (Arnett, 2000). The protective influences of these life events are well documented (e.g. McGloin et al., 2011; Sampson & Laub, 1993; Uggen, 2000). If imprisoned during emerging adulthood, individuals may

miss important opportunities gain social capital that is essential to their future success (Schwartz et al., 2016). Imprisonment during this formative time may also force "off time" transitions like late marriage or entry to the labor market. Off-time transitions are not only informally sanctioned within social groups, they can be associated with psychological strain, anxiety, and a general detrimental impact on the individual (Elder, 1985; McLanahan & Sorensen, 1985). To boot, opportunities to form social bonds (e.g., mate selection, available jobs, and educational opportunities) shrink with age and the remaining options may be lower quality or have fewer prosocial qualities (e.g. low wage jobs) (Booth & Edwards, 1985; Cooney & Hogan, 1991; Stettersen & Mayer, 1997).

On top of potentially stunted cognitive development, criminal role taking, deviant peer influence, and restrictions and delays in the acquisition of prosocial capital, individuals of different ages may experience imprisonment differently. Young adult inmates are also more likely to be victimized in prisons (Perez et al., 2010) and be involved in serious rule violations or escape attempts (Steiner et al., 2014). All else being equal, younger inmate receive harsher punishments in that they are more likely to spend time in disciplinary custody or solitary confinement than older inmates (Butler & Steiner, 2017). Younger inmates also serve longer prison and parole sentences than older inmates, and are housed at higher custody levels.   These age-graded differences in the prison experience are consequential for behavior. For adults, stints in segregation are associated with deterioration of cognitive capacities and mental health (Arrigo & Bullock, 2008; Haney, 2003), future behavioral problems within prisons, and recidivism upon release (Lovell et al., 2010; Mears & Bales, 2009).

It is hypothesized that imprisonment is more likely to function as a negative turning point when experienced earlier in the life course, particularly if it occurs during emerging adulthood (ages 18-25). Because emerging adulthood is a time for exploring future possibilities (Arnett, 2000; Schwartz et al., 2016), imprisonment during this formative time is particularly detrimental. Difficulty adjusting to the prison environment, limited cognitive capacities, criminal identification, and restrictions on social capital hinder prosocial development and reduce the likelihood of law abiding behavior following release from imprisonment. In a more basic sense, if an individual is younger when entering prison, he or she will be younger at release, and therefore less likely to naturally desist from crime. As such, the likelihood of observing a discontinuity in offending consistent with a positive turning point is lower earlier in the life course.

Hypothesis 3: Imprisonment is more likely to serve as a negative turning point among younger adults, especially those in emerging adulthood.

2.3.3. Treatment Effect Heterogeneity: Age at the Time of First Time Imprisonment

As noted above, the first time an individual is sent to prison is when family bonds are likely weakened, education is interrupted, jobs are lost, and identity change first occurs. While these stressors are relevant for repeat prisoners, their influence on behavior could be concentrated at the first imprisonment. If first-time imprisonment and its consequences occur earlier in the life course, prosocial opportunities may be weakened, lost, or permanently knifed off. Imprisonment reduces the likelihood of marriage (Apel et al., 2010), educational attainment (Pettit & Western, 2010), and employment (Pager, 2003), all of which are traditionally established during emerging adulthood. If imprisoned for the first time during this life stage, these bonds may never form. Younger individuals may be more likely to develop criminal identities when imprisoned for the first time, and

absent existing prosocial adult identities, this criminal role may become a master status. By contrast, if first imprisonment occurs later in the life course, it is possible that some pre-prison ties and prosocial adult identities exist. Older first-time prisoners or parolees may sever ties when imprisoned, but may also have a pre-existing network to return to upon release. Older individuals may also have experience in prosocial adult roles which may increase success following first-time imprisonment, such that criminal role-taking is less likely. Those imprisoned earlier in the life course may not have the same networks to return to, and during a time of identity exploration (Arnett, 2000), may be more greatly impacted by the socialization that occurs with the first imprisonment.

Older individuals are more likely to estimate and place weight on the costs of punishment, meaning that they are more cost averse and more effectively deterred by the prison experience (Cusson & Pinsonneualt, 2014; Shover, 1983). By contrast, younger individuals are reward driven and sensation-seeking (Steinberg & Gardner, 2005). Though first-time imprisonment may be a strong deterrent, younger inmates may be less influenced by the costs of punishment and more swayed by the rewards to criminal behavior upon release. This is particularly true if they perceive the prison environment as less harsh, imposing fewer harms. Some inmate surveys suggest that older inmates view the prison environment as harsher and more straining than younger inmates (Maguire, 1982). Together, this evidence suggests that first-time imprisonment is less likely to yield offending reductions among younger individuals because it is a less effective deterrent for this group. As such, it is hypothesized that first-time imprisonment occurring earlier in the life course is most likely associated with a negative turning point.

Hypothesis 4: First time imprisonment is more likely to serve as a negative turning point when it occurs earlier in the life course.

2.4 Modeling Treatment Effect Heterogeneity: Group Based Trajectory Modeling

With potential heterogeneity in the relationship between imprisonment and crime generated from a variety of sources, an average "effect" likely masks important variation. One way that criminologists have examined heterogeneity in offending and other outcomes is through the use of group based trajectory analyses. Group based trajectory modeling (GBTM) is a semiparametric extension of finite mixture modeling (Nagin, 2005; Nagin & Tremblay, 2001). Unlike growth curve or hierarchal linear modeling[7], GBTM is predicated on the assumption that the population is comprised of a discrete number of groups that follow unique developmental paths (Nagin, 2005; Nagin & Land, 1993; Nagin & Tremblay, 2001). GBTM reveals heterogeneity in a sample by identifying and explicitly modeling groups of individuals with distinct developmental patterns.

GBTM is data-driven approach used to reveal complexities in longitudinal data. The model estimates a predetermined number patterns in the outcome of interest, allowing the data to dictate the shape and level of each trajectory (for example patterns of arrest). The model then classifies each observation into the trajectory group with the pattern most similar to its own behavior, and estimates the proportion of the population in each trajectory group. To be clear, the trajectory groups are a product of the estimation process. They do not represent real groups in the population, and individuals are assigned to trajectory groups with uncertainty (Nagin, 2005; Nagin & Tremblay, 2005a). Nagin and Tremblay (2005b) describe trajectory groups as "latent strata in longitudinal data that distinguish clusters of individuals following distinctive developmental paths" (p. 290), but these paths are not followed deterministically nor do they represent actual classes of

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[7] See also Bushway et al., 2009; Muthen & Curren, 1997; Raudenbush, 2001 for a review of these other methods.

offenders. GBTM is a data reduction technique, providing a simple way to assess heterogeneity in a sample over time.

Trajectory analyses are now commonplace in criminology and have thoroughly expanded what is known about criminal behavior (Jennings & Meade, 2016; Piquero, 2008; Nagin, 2016). Originally, GBTM was developed to test taxonomic theories of crime (e.g. Nagin et al., 1995), but trajectory analyses are now used to identify variability in a variety of criminological outcomes. Some of these outcomes include offending (Bushway et al., 2009; Laub et al., 1998), imprisonment stays (Eggelston-Doherty et al., 2009), arrests prior to prison (Nieuwbeerta et al., 2009; Tahamont et al., 2015), substance use (Teruya & Hser, 2010), child abuse (Stewart et al., 2008), and prison visitation (Hickert et al., 2017)[8]. These studies reveal extensive heterogeneity in a variety of criminal justice outcomes, providing evidence of the multiple pathways to and from criminal behavior.

2.4.1 Trajectory analyses and the study of turning points

Because of its longitudinal character and ability to appraise heterogeneity in offending, GBTM is a staple tool for life course criminologists (Nagin & Piquero, 2010; Nagin, 2016). Despite the proliferation of trajectory studies in criminology, relatively few turning point studies implement a GBTM approach. Instead, criminologists rely heavily on two approaches: narrative accounts of life events and econometric identification strategies (Laub & Sampson, 2003 and see Nguyen & Loughran, 2018 for a review).

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[8] Important extensions to the traditional GBT approach exist. Haviland and Nagin (2005) extended the use of traditional GBT modeling to include estimation precise treatment effects. They argue for scholars to make within-group comparisons of the outcome of interest and integrate matching designs as a means to rigorously model causal relationships and account and account for unobserved heterogeneity (Haviland et al., 2008). GBT analysis are also used to account for non-random participant attrition in panel data (Haviland et al., 2011).

Narrative accounts derived from ethnographies or life history interviews provide detailed explanations of how offenders interpret the sources of their own criminal behavior (Carlsson, 2012; Laub & Sampson, 2003; Shaw, 1930). These data paint a clear picture of the turning point's context and the ways in which development changed. Though detailed descriptions of the turning point are valuable, qualitative accounts cannot establish causal relationships between the proposed turning point and criminal behavior, and can be subject to memory and reporting biases (Blokland & Nieuwbeerta, 2005; Mosher et al., 2010).

Quantitative studies of turning points are diverse and, in many cases, methodologically rigorous. Analytic strategies to discern turning points include matching designs (Blomberg et al., 2012; King et al., 2007), path analyses (Walters, 2017), fixed effects regressions (Bersani & Doherty, 2013; McGloin et al., 2011), instrumental variable analyses (Kirk, 2012), inverse probability treatment weighting (Wimer et al., 2008) and even experimental designs (Uggen, 2000). Despite their rigor, many of these methods pose challenges to the study of turning points. As mentioned earlier, these challenges include strictly exogenous treatment of the turning point and the assumption of uniformity in the turning point and its effect on behavior. These models may oversimplify or distort the relationship between life events and crime. A GBTM approach may fill this gap, and should be used in conjunction with these methods to address all measurement and conceptual attributes of turning points previously discussed.

A few studies have utilized trajectory methods to study turning points. Laub, Nagin, and Sampson (1998) use group based trajectory models to estimate the relationship between marriage and desistance. To account for pre-existing differences, or

"persistent heterogeneity" across offenders that may drive both criminal behavior after marriage and marriage itself, the authors estimate trajectories of offending prior to marriage (p. 226). They then use trajectory group membership to predict the number of arrests after marriage. In this way, persistent heterogeneity is statistically controlled for, reducing potential bias in estimating the marriage effect. Laub and colleagues (1998) find that marriage has initial preventative impact but this protective influence wanes over time. Only quality marriages, marked by strong investments in the relationship over time, elicit sustained reductions in arrests.

As a second example, in their analysis the impact of grade retention of violence, Nagin and colleagues (2003) utilize a trajectory approach to estimate patterns of aggression preceding grade retention. Estimating aggression trajectories before grade retention serves as a method to assess pre-existing unobserved differences between individuals and to assess whether the impact of grade retention depends on the prior developmental trajectory. The authors find that the impact of grade retention is contingent upon the previous aggression trajectory; grade retention has no impact on violence among the chronic aggressive children or the non-aggressive children, and is only a turning point (in aggression or violence development) among moderately aggressive children (Nagin et al., 2003).

These two studies underscore three important benefits to utilizing trajectory models in the study of turning points. Primarily, GBTM allowed the researchers to assess heterogeneity in offending before the proposed turning point and account for "persistent unobserved heterogeneity" (Sampson & Laub, 1995, p. 145). Accounting for pre-turning point differences reduces selection bias in estimating turning point effects, a task which

eluded scholars in the past. Additionally, heterogeneity in the effect of a turning point may be discerned with a trajectory approach. In the second prior example, the trajectory approach allows the authors to appraise for whom grade retention does and does not alters behavior (e.g. treatment effect heterogeneity). More generally, GBTM allows for an assessment of heterogeneity in criminal behavior, a task worth praising on its own. If criminal trajectories were estimated after a proposed turning point, the outcome of a turning point could be longitudinal sequence of behavior, and heterogeneity in this behavior could be assessed. This measurement is consistent with the original definition of a turning point and allows researchers to assess abrupt and gradual behavioral changes, along with variations in criminal behavior.

2.4.2. Present Study

The present study uses a dual trajectory model to capture potential changes in offending before and after prison. Analytically, the dual trajectory model is a simple extension of the traditional GBTM framework; it involves the estimation of two trajectory models rather than one, either for two distinct outcomes or one outcome observed in two time periods (Nagin, 2005). The same procedures for model selection are utilized to estimate the appropriate number of groups for each outcome[9]. Once the appropriate number of groups are selected for both outcomes, the dual model simultaneously estimates the two trajectory models and calculates the relationship between the trajectory groups (Nagin, 2005). The dual trajectory analysis generates many important outputs, but of particular interest is a matrix of conditional probabilities that reflect the likelihood of assignment to a trajectory group in one model conditional on assignment to a specific group in the other model (known as the transition matrix and

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[9] Model selection criteria and procedures are detailed in Chapter 3.

transition probabilities)[10]. In the present study, the dual model estimates pre-prison arrest trajectories and post-prison recidivism trajectories, so the conditional probabilities reflect the likelihood of transitioning to a post-prison recidivism trajectory, conditional on membership in a pre-prison arrest group. Depending on the patterns of arrest and recidivism observed, transitions between trajectory groups may indicate discontinuity consistent with a turning point. Constrained multinomial logistics regressions utilizing these transitions as outcomes allow for the assessment of the factors that distinguish the transitions between trajectories (Nagin, 2005), thus revealing correlates of turning points.[11]

The dual trajectory model has been used once before to assess whether grade retention, substance use, and gang membership serve as turning points in aggression and violence (Nagin et al., 2008). In this study, Nagin and colleagues (2008) estimate trajectories of childhood aggression ages 6-13 and adolescent violence ages 13-17, and the transitions between the resulting trajectory groups. The authors then use binary indicators of the proposed turning point events (occurring at the transition between ages 12-13) to predict the transition from childhood to adolescent trajectory groups. They find that substance use at age 12 consistently relates to transitions, and conclude that it is a

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[10] An illustrative example is useful here. Eggelston-Doherty and colleagues (2009) utilize a dual trajectory model to assess the relationship between juvenile imprisonment and adult crime. They select a 5-group model to describe heterogeneity in juvenile imprisonment and a six-group model to describe adult offending. The transition matrix thus provides the conditional probability of assignment to a single adult offending group conditional on assignment to a juvenile imprisonment group. For example, the probability of being high rate chronic adult offender conditional on experiencing juvenile imprisonment at a high rate is 0.112 (p. 203). The transition probabilities can also be interpreted as the probability of high rate chronic offending in adulthood, controlling for the longitudinal pattern of juvenile imprisonments.

[11] Dual trajectory analysis, as it is employed in the present study, only allows for the investigation one change point or discontinuity in the criminal trajectory, occurring at the transition between two temporally distinct criminal trajectories. Other methods, like fixed effects regressions or variations of the GBTM approach may allow for the estimation of multiple turning points in a criminal trajectory.

turning point the aggression trajectory. Grade retention and gang membership have less consistent influences (Nagin et al., 2008).

A dual trajectory framework is a promising new approach to the study of turning points. The benefits of this analysis extend beyond controlling for pre-existing differences between groups or making within-group comparisons, as prior studies of turning point events have done (e.g. Nagin et al., 2003). The dual trajectory model allows for the assessment of discontinuity in a behavioral path by connecting two statistical trajectories representing different parts of the overarching pathway (Nagin et al., 2008). With respect to imprisonment, a dual trajectory model can estimate trajectories of offending before and after prison as a way to model the criminal career. The model also reveals how individuals transition between the two parts of the criminal pathway, which provides a way to assess discontinuity in offending that may be suggestive of a turning point by comparing patterns of criminal behavior pre- and post-turning point.

The present dissertation builds off the work of Nagin and colleagues (2008) because it does not assume that each transition between trajectory groups is indicative of a turning point. Instead, there must be evidence of a break or change in the trajectory patterns to infer a turning point. These discontinuities can be discerned by comparing the pattern and level of offending of the pre-prison and post-prison trajectory groups. The necessary and sufficient criteria for discerning these discontinuities and classifying transitions as turning points are detailed in Chapter 3 (Data and Methods). Though this method is useful for discerning change in behavior before and after a certain point when two statistical trajectories start and end, the researcher must make an a priori assumption about the timing that the turning point occurs to utilize this analytic approach. Changes in

criminal behavior occurring at different times cannot be identified with a dual trajectory model.

In the present study, the dual trajectory model imposes a finite duration on the turning point by assuming that it occurs between the two estimated trajectories. This method marks another departure from Nagin and colleagues (2008), but is logical because imprisonment has a fixed, known duration. The admission date marks the end of the pre-prison offending period and the release date marks the beginning of the post-release offending period. No criminal behavior can be observed in between. Given the difficulty measuring the duration of other turning points and ambiguity surrounding when the influence of a turning point can be observed, a definitive is beneficial because time frame establishes both temporal order and clearly defines the period in which behavioral change following a turning point occurs.

Most importantly, the dual model intrinsically allows for an assessment of heterogeneity in offending before and after the imprisonment, and puts no restrictions on the direction of behavioral change that occurs. Depending on the observed offending patterns before and after prison, individuals may exhibit offending increase, decrease, or no change. The method can therefore detect offending amplification (negative turning point), reductions (positive turning point), and continuity (no turning point) and allows for multiple pathways to each. Multinomial logistic regressions further the assessment of heterogeneity, allowing the transitions (or turning points) to be conditioned by individual traits, imprisonment experiences, and parole experiences. Thus, the significant correlates of positive, negative, and non-turning points can be discerned.

With these benefits, the dual trajectory approach can serve as an important supplement to prior research on turning points. Other methodological approaches can estimate the causal effect of life events on criminal behavior, something the dual trajectory model cannot accomplish. However, a dual trajectory approach allows one to discern whether there is discontinuity in the overarching criminal trajectory by comparing patterns of criminal behavior before and after the proposed turning point. Heterogeneity in criminal behavior before and after a proposed turning point can be assessed, along with heterogeneity in how behavior changes. New insights regarding turning points and changes in criminal behavior may be discerned by measuring turning points in this different, more descriptive way.

CHAPTER 3: DATA AND METHODS

The purpose of this research is to integrate principles of life course criminology into the study of imprisonment by conceptualizing and measuring imprisonment as a turning point in the criminal career. The dual trajectory model is an analytic technique that reduces the complexities of longitudinal criminal history data by identifying and linking latent offending patterns before and after prison. Considering how the progression and level of offending varies before and after prison can suggest a change or discontinuity in criminal behavior that is indicative of a turning point. Post-trajectory regression analyses reveal the inmate, prison, and parole characteristics that are significantly associated with transitioning between pre- and post-prison offending trajectories. With the life course principles of cumulative disadvantage and timing in mind, an inmate's prior imprisonment history and age at admission to prison are the focal variables of these analyses.

This work is descriptive and exploratory in nature; it does not establish a causal relationship between imprisonment and crime, nor does it impose assumptions on the direction of change in criminal behavior following imprisonment. Although the theoretical rationale behind considering imprisonment as a turning point in the criminal career rests on the assumption that imprisonment causes changes in crime, this work cannot identify a causal relationship. Instead, correlates of discontinuities in criminal offending (both increases and decreases) are thoroughly described to provide some context in assessing the extent to which imprisonment serves as a positive, negative, or non-turning point in the criminal career. This approach is a departure from prior work on turning points and the study of prison and crime. However, it serves as an important

supplement to the extant literature that provides a more refined understanding of the imprisonment-crime relationship, and whether imprisonment should be considered a turning point.

3.1 Data Sources and Sample Selection

This research focuses on imprisonment and offending in Pennsylvania. Pennsylvania is the seventh largest state correctional system in the United States, home to 24 prisons, 1 motivational boot camp, and 14 state-run community corrections centers (Bucklen, 2015; PADOC, 2018). More than 374,000 individuals are currently under correctional supervision in Pennsylvania. In 2016, Pennsylvania prisons housed almost 50,000 inmates (Carson, 2018). Over 20,000 inmates were admitted in 2016 and nearly 71,000 were released onto parole supervision (Kaeble & Bonczar, 2016).

Pennsylvania follows an indeterminate sentencing scheme with presumptive sentencing guidelines and discretionary parole release. Once a defendant is convicted of a crime in Pennsylvania, a judge assigns both a minimum and a maximum sentence length in accordance with the guideline recommendation.[12] If an individual is sentenced to prison (rather than probation or an intermediate sanction), he or she is eligible for parole release only at or after the minimum sentence date. The parole board determines if and when an individual is released onto parole supervision, and under what release conditions. An inmate can be released on parole any time in between the minimum and maximum sentence dates, and the length of parole supervision is the amount of time from the release date to the maximum sentence date. If the parole board consistently denies an

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[12] Guideline recommendations are determined by an offense gravity score and prior record score. There are 13 offense gravity categories ranging from Murder (score of 13) to possession of small amounts of marijuana (score of 1). Prior record scores range from zero to 5, with two additional categories for repeat felony offenders and repeat violent offenders (Pennsylvania Sentencing Commission, 2012). The guideline grid contains sentences to state prison, intermediate sanctions, and county jails.

individual parole, then he or she has "maxed out" and is released from prison unconditionally on the maximum sentence date.

The data for this research are provided by multiple Pennsylvania criminal justice agencies, including the Pennsylvania State Police (PSP), the Pennsylvania Department of Corrections (PA DOC) and the Pennsylvania Board of Probation and Parole (PBPP)[13]. The sample was first defined by PBPP; they created a list of all individuals released from any of the 24 state prisons onto parole supervision between January 1st, 2006 and December 31st, 2008. Data on individuals who "maxed out" their prison sentences and were released unconditionally were not provided. In 2012, 21% of Pennsylvania prison releases qualified as "max outs" (Pew, 2014), a proportion that is slightly below the national average of 22% of prison releases. Research demonstrates that individuals who max out their prison sentences have longer criminal histories, engage in more serious offending, and recidivate more frequently and quickly upon release from prison (Ostermann, 2012; Pew, 2014). Failure to include these individuals in the present study limits the generalizability of conclusions that can be drawn regarding imprisonment as a turning point. The findings apply only to PA parole releases occurring between 2006 and 2008. Excluding max-outs may also understate that variability in criminal offending before and after if they are highly active criminals. Lack of variability in criminal behavior has important implications for the execution of group based trajectory models. These implications are discussed in Chapter 5. Excluding individuals released from prison unconditionally also means all that for everyone in the sample, the prison experience is accompanied by a period of parole supervision upon release. As such, this

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[13] The data were gathered from the respective PA criminal justice agencies by the PA DOC's division of research, planning, and statistics. Data files were uploaded to a secure location and transferred to the researcher electronically.

study cannot assess whether prison alone is a turning point in the criminal career, but instead captures whether the joint experience of prison and parole supervision is associated with discontinuity in offending.

The total sample includes 28,971 unique individuals released to parole between 2006 and 2008. Individual inmates were identified by their control numbers, which are generated at the time of admission to a PA prison. When an inmate is received by a PA prison, the agency searches the individual's name, date of birth, social security number, and State Identification number (generated by the PSP based on fingerprints) to determine if an existing control number exists. If so, the inmate retains the previous control number and if not, a new control number is generated. This process ensures that an individual's control number remains same over the criminal career and that inmate records are linked over multiple prison terms.

The PSP provided adult arrest histories, or rap sheets, for all individuals in this sample. Rap sheets include the dates and charges of all adult arrests (individual is over 18) in the state of Pennsylvania occurring prior to December 31st, 2014.[14] The 2006-2008 release time-frame was selected because the completeness of DOC and parole records is ensured back to 2006 (Bucklen, 2015), and because it allows at least a 6 year follow up period to estimate post-prison criminal trajectories with rap sheet arrests. With prison admission and release dates, rap sheet arrests are separated into the pre- and post-prison time frames based on their dates.

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[14] PA rap sheets likely underestimate criminal activity before and after imprisonment. Rap sheets do not include arrests occurring outside the state of PA. It is possible that individuals were arrested in neighboring states and PA rap sheet miss those arrests. These rap sheets similarly exclude arrests made by the federal government. It is also possible that in the periods surrounding the imprisonment experience an individual was incarcerated in a neighboring state. Because of PA's geographic proximity to New Jersey and Delaware, and the proximity of high crime cities in both states (for example Camden, NJ and Philadelphia, PA are less than 6 miles apart, separated by the Delaware River).

Each arrest is given an offense tracking number (OTN) once it is recorded into the PSP database. OTNs are person-specific arrest identifiers. Criminal incidents involving multiple charges are given the same OTN if the individual was arrested for multiple charges at one time. For incidents involving multiple arrestees, each person is given a separate OTN. OTN are matched to unique individuals using State Identification Numbers (SIDs). SIDs are generated at the time of first arrest based on an individual's fingerprints (Carpenter, 2008). Each time an individual is arrested or booked in PA, fingerprints are taken, such that every OTN can be linked to an existing SID number, or a new SID number is generated. Rap sheets contain all OTNs associated with a fingerprint, and therefore include the all adult arrests for each individual in the sample.

Rap sheets are matched to PADOC inmate records using the inmate's State Identification Number (SID). Each DOC control number is associated with a single SID number. Less than 2% of the original sample's control numbers could not be matched to PSP rap sheets (N=447). Unmatched observations are excluded from the analysis, reducing the sample size to 28,524. Furthermore, because only adult rap sheets were available, arrests prior to age 18 are not included. For this reason, the analytic sample is limited to individuals imprisoned at age 22 or later. This age restriction is necessary to allow for a four-year observation window (18-22) to estimate pre-prison criminal trajectories prior to the focal imprisonment. With the age restriction, the full analytic sample includes 24,892 individuals.

PADOC provided data on inmate demographics and in-prison experiences drawn from their inmate record database. They also provided access to each inmate's misconduct history, custody information, and in-prison program participation. All DOC

files are linked using the inmates' control numbers. The PBPP provided data on post-release parole supervision and compliance. These data are matched to individual inmates' rap sheet files using the unique DOC control number. More information on each data source is provided in Sections 2.2 and 2.3.

These data are uniquely suited to explore imprisonment as a turning point, as they contain a variety of ways to measure criminal activity and criminal justice involvement, including arrests, parole violations, and imprisonments. Large amounts of data on criminal activity are available both before and after a prison term. In addition, the analysis utilizes the full population of parole releases,[15] which provides sufficient statistical power for the dual trajectory model and generalizability. The presence of data to capture imprisonment experiences, inmate demographics, and the parole contexts allows for an assessment of heterogeneity in the imprisonment experience and as well as a description of the subpopulations for whom imprisonment serves as a positive or negative turning point in the criminal career. Including these measures as control variables also increases precision in estimating the relationships between prior imprisonments, age and transitions between trajectory groups, which are the focal variables of this work.

3.2 Measures and Descriptive Statistics

Data from all three PA criminal justice agencies were merged into an inmate-level longitudinal file comprised of arrests leading up to the prison term from which an inmate was released during the 2006 and 2008 sampling window (hereafter called the focal

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[15] As a discretionary parole state, PA does not release all its inmates onto parole. Some inmates are consistently denied parole release or refuse to be released prior to their maximum sentence data. The sample excludes individuals these individuals who "max out" for either reason. Given the documented differences between those who are paroled and those who are not (Ostermann, 2012), this omission limits the study's generalizability slightly.

imprisonment), and criminal justice involvement in the six years following release. Additional measures of prison experiences, parole supervision, and inmate characteristics were added to this file, linked by the DOC control number. A description of these variables and all descriptive statistics are provided below.

3.2.1 Dependent Variables

The primary dependent variables for this study are the transitions that link pre- and post-prison criminal trajectories. Transitions are generated by estimating trajectories of criminal behavior before and after prison simultaneously, such that each individual is classified into a pre- and post-prison group and the relationship between trajectory groups may be calculated. In other words, the dual trajectory model and subsequent pre- and post-prison criminal trajectories serve as analytic tools to generate the dependent variable of interest.

Criminal trajectories were measured by arrests and/or imprisonments occurring the four years preceding and following the focal imprisonment[16]. Arrests include all criminal arrests for which an individual was "booked" and a fingerprint was taken. Imprisonment refers to entry into any PA prison, include reception and diagnostic centers, as a result of a court commitment or parole revocation. Imprisonment does not include pre-trial detention or incarceration in a local jail or community corrections center.

Pre-prison trajectories were measured with adult arrests in the four years prior to the focal imprisonment. The PADOC provided the dates on which an inmate was received by any PA state level adult correctional facilities. The date of admission for the focal imprisonment marks the end of the pre-prison period. Looking back from the

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[16]The focal imprisonment refers to the prison term for which an individual was released in the 2006-2008 window. This is the prison term that meets the sampling criteria for the present study.

admission date, the four years prior to imprisonment was divided into eight six-month intervals. Because self-reported criminal behavior was not available, arrests before the focal imprisonment were used to approximate a criminal offending trajectory. More precisely, trajectories of criminal justice involvement were estimated. PSP rap sheets contain all adult arrests occurring in the state of Pennsylvania and the date on which each arrest occurred. All arrests occurring in the four years prior to the focal imprisonment were classified into one of the eight pre-prison time periods. Dichotomous measures of arrest in each time periods were generated. The pre-prison arrest trajectory captures the probability of arrest across the pre-prison period using logistic regressions. On average, inmates are arrested six times prior to prison (SD= 6.05), but only 2.43 of those arrests occur in the four years prior to the focal imprisonment (SD=2.22).

In the post-prison period, criminal trajectories were approximated with official measures of recidivism, including arrest or re-incarceration in a state prison in the four years following the focal imprisonment. Because all individuals were released to parole supervision following the focal imprisonment, it is possible that criminal behavior detected by parole agents leads to re-incarceration without any arrest. The behavior that elicits re-imprisonment without an arrest is analogous to other criminal behavior that does result in arrests. In PA, parole officers have a variety of sanctions available to punish parole violators[17]. Parole revocations and re-incarceration in a state prison result from continual or high severity violations, including but not limited to absconding, assaultive

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[17] The PBPP devised a parole violation and sanction grid to guide parole officer discretion in punishing parole violations. The grid dictates appropriate sanctions conditional on the severity of the parole violation (classified into three categories), the parolee supervision level, prior sanctions, and the parole LSI-R risk assessment score. Re-incarceration is deemed a high-level sanction. It is only available for medium and high severity violations committed by high risk parolees on maximum supervision, or high severity violations committed by parolees on medium supervision (PBPP, 2012). It is also only one of seven high level parole sanctions that can be imposed for this group, so parole officers have discretion to impose other sanctions.

behavior, pending criminal charges, or possessing firearms. Failure to include re-incarcerations without arrests would miss these incidents and underestimate criminal offending and criminal justice contact post-release.

Post-prison trajectories were estimated beginning the day an inmate was released from the focal imprisonment. The four-year post-prison window was divided into eight six-month intervals. Post-prison offending was measured dichotomously such that eight binary indicators of re-arrest or re-imprisonment (hereafter collectively called recidivism) were generated. Arrest data come from two sources: 1) PSP rap sheets containing any arrest made by a PA police officer and 2) arrests made by PA parole officers. Re-imprisonment is measured with official PADOC records indicating entry to a PA state prison. Re-imprisonment can occur from either parole revocation or new criminal charges.

Both the pre- and post-prison trajectories were estimated with logistic regressions. Once the appropriate number of pre- and post-prison trajectory groups were selected, the dual trajectory model simultaneously estimated the pre- and post-prison criminal trajectories to reveals the connections between the trajectory groups. The dual trajectory analysis produced j pre-prison trajectory groups, k post-prison trajectory groups, and j x k transitions. Transitions between trajectory groups may suggest increase, decrease, or no change in criminal behavior depending on the level and progression of arrest or recidivism in each trajectory. When the two trajectories suggest discontinuity in criminal behavior, a turning point may be inferred. In this dissertation's analyses, these transitions are utilized as dependent variables in two ways. First, the transitions between pre-and post-prison trajectories themselves were the dependent variable. Each transition was

classified as reflecting a positive, negative or non-turning point and the prevalence of each type of discontinuity was considered across analytic samples (Section 4.2). A categorical measure grouping each type of transition was generated as the second dependent variable (Sections 4.3, 4.4, and 4.5). Multinomial logistic regressions utilizing this measure revealed the predictors of each type of transition and shed light on the correlates of potential turning points.

3.2.2 Independent Variables

Though this research seeks to determine if imprisonment serves as a turning point in the criminal career and to identify sources of heterogeneity in how imprisonment relates to offending, imprisonment itself was not an independent variable. All individuals in this sample were incarcerated and released from prison between 2006 and 2008. The dependent measure captures discontinuity in criminal trajectories before and after prison was observed to suggest prison is a turning point. Individual-level characteristics indicative of other features of turning points (e.g. age reflects the turning point's timing) served as the primary independent measures in this dissertation. To assess life course principles of cumulative disadvantage and timing, the primary independent variables in this analysis were prior imprisonments and inmate age at admission to prison.

The DOC inmate records database contains the number of prior stays in any PA prison for each inmate. Prior imprisonments do not include jail stays, pre-trial detentions, or stays in community correction centers, and are measured relative to the focal imprisonment. For example, if an individual was released from a PA prison in 2006 and was incarcerated once before 2006 and twice upon release during the follow up period, this individual would be recorded as having one prior imprisonment. To assess

cumulative disadvantage, a count variable capturing number of prior prison terms was generated. This variable was used to identify first time prisoners (N=13,155) and individuals with one or more prior imprisonments (N=11,737) Most inmates in the sample are first-time prisoners (roughly 50% of the sample), but some inmates were incarcerated in a PA prison more 10 times prior to the focal imprisonment. Twenty percent of the sample had only one prior prison stay and the final twenty percent was imprisoned two or more times before the focal imprisonment. To be clear, only a single prison term was under investigation in the present study. Prior incarcerations are not measured longitudinally, as the dates and sentence lengths were unknown.

To assess how the timing of imprisonment influences whether a turning point is observed, I focus on the inmate's age at admission to prison. Inmate *age at admission to prison* was not provided by the PA DOC was calculated using the inmate's date of birth and the date of prison admission. On average, inmates were 32.84 years old when entering a PA prison (SD=9.89). In addition to a continuous measure of age, a dummy variable was generated to capture admission to prison during emerging adulthood (ages 22-25). Emerging adulthood is the primary theoretical construct of interest in the analysis of timing, because imprisonment during this crucial time may inhibit individuals form forming pro-social attachments that promote desistance (Laub & Sampson, 2003). For this reason, inmates experience imprisonment between the ages of 22 and 25 were grouped and then compared to individuals who experience imprisonment later in life. Separate post-trajectory multinomial regressions were run with the continuous and binary measures of age. The continuous measure of age demonstrates whether younger inmates

are more likely to experience particular transitions, thus evaluating hypothesis 3, and

emerging adulthood was assessed with binary measure.

Table 1. *Descriptive Statistics for Full Sample of Parolees (N=24,892)*

Variable	Mean	Standard Deviation	Median[18]	Minimum Value	Maximum Value
Pre-Prison Arrests	6.502	5.849	5.000	1	92
Prior Prison Terms	0.939	1.354	0	0	20
First Time Prisoners	0.528	0.499	---	0	1
Repeat Prisoners	0.472	0.499	---	0	1
Arrest 4 Years Following Prison	0.652	0.476	---	0	1
Re-imprisonment 4 Years Following Prison	0.579	0.494	---	0	1
Age at Admission to Prison (Years)	34.631	9.278	32.930	22.000	81.06
Male	0.912	0.282	---	0	1
Race/Ethnicity					
White	0.400	0.490	---	0	1
Black	0.474	0.499	---	0	1
Hispanic	0.121	0.326	---	0	1
Other	0.005	0.072	---	0	1
Marital Status					
Single	0.687	0.464	---	0	1
Married	0.173	0.378	---	0	1
Divorced	0.091	0.288	---	0	1
Separated	0.034	0.182	---	0	1
Widow	0.010	0.098	---	0	1
Commitment Offense					
Violent	0.279	0.448	---	0	1
Property	0.200	0.400	---	0	1
Drug	0.344	0.475	---	0	1
Other	0.177	0.381	---	0	1
Time Served (Years)	2.379	2.630	1.518	0.005	32.499
Custody Level Score	2.568	0.594	2.535	1	5
Any Misconduct	0.608	0.488	---	0	1
Misconduct Rate (Incidents per Year)	1.953	3.521	0.580	0	16.35
Misconduct Type					
Violent	0.140	0.347	---	0	1
Property	0.238	0.426	---	0	1
Drug	0.072	0.259	---	0	1

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[18] Median values are not reported for variables that are measured dichotomously.

Other	0.453	0.498	---	0	1
Disciplinary Custody (Days/Year)	0.131	1.528	0.041	0	175.625
Any Program Participation	0.822	0.382	---	0	1
Program Type					
Alcohol/Drug	0.618	0.330	---	0	1
Anger Management	0.051	0.219	---	0	1
Counseling	0.139	0.346	---	0	1
CBT	0.334	0.471	---	0	1
Education	0.154	0.360	---	0	1
Misconduct Free	0.035	0.185	---	0	1
Parenting	0.093	0.292	---	0	1
Reentry Planning	0.187	0.390	---	0	1
Sex Offender	0.037	0.189	---	0	1
Violence Prevention	0.406	0.491	---	0	1
Work-Related	0.032	0.177	---	0	1
Parole Length (Years)	3.918	4.177	2.537	0.005	60.000
Initial Parole Supervision Level					
Minimum	0.395	0.489	---	0	0
Medium	0.399	0.490	---	0	0
Maximum	0.186	0.389	---	0	0
Halfway House	0.529	0.499	---	0	1

3.2.3 Control Variables

This dissertation involved identifying discontinuities between pre- and post-prison criminal trajectories and classifying those transitions as reflective of positive turning points, negative turning points, or non-turning points. In addition, multinomial logistic regressions were estimated to discern the correlates of these transitions, focusing specifically on how prior prison terms and age at imprisonment relate to transitions deemed positive and negative turning points. To reduce bias in estimating these relationships, a series of control variables are employed. These control variables are

divided into inmate characteristics, characteristics of the prison experience, and parole supervision measures.

3.2.3.1 Inmate Characteristics

The PA DOC inmate records database contain rich demographic information on all inmates in PA custody. Inmate sex was measured dichotomously, capturing whether the inmate is *Male*. Almost 92% of parolees released from PA prisons during the study period were male. *Inmate race and ethnicity* was measured an inmate's self-reported race or ethnicity at the time of admission. Inmates reported their race or ethnicity as White, Black, Hispanic, Asian, Indian, or Other race and their responses were recorded as mutually exclusive categories. There was no opportunity to identify with multiple groups. Nearly half of the sample was Black (47.4%), 40% was White, and 12% was Hispanic. The Other Race category includes Asian, Native-American Indian and inmates classified as "other race" by the PA DOC. This group comprised less than one-percent of the sample. The categorical race/ethnicity measure was deconstructed into binary indicators of inmate race/ethnicity. In the multinomial models described below, White inmates serve as the reference category.

Marital status was also included as a statistical control. Inmates self-reported their marital status at the time of entry from prison but could alter their status throughout the imprisonment stay. The information provided by DOC contains only the marital status measured at the time of release, and does not capture whether this status was changed during the period of imprisonment. At the time of release, the over 70% of

inmates reported their marital status as *single*[19]. Roughly 17% of inmates were *married* at the time of release, 3% were *separated* and 9% were *divorced*.

Commitment offense refers to the type of crime for which an individual was imprisoned. Violent, property, drug, or other crimes are categorized according to the Pennsylvania Criminal Code. Examples of *violent* crimes include homicide, robbery, rape, and aggravated assault. *Property* crimes include, but are not limited to, burglary, theft, and receiving stolen property. *Drug* crimes involve the possession and distribution of controlled substances. *Other* crimes contain both public order offenses and unclassified offenses such as fire-arms violations or criminal conspiracy. Roughly one-third of the sample was incarcerated for a drug crime[20]. Given the disproportionate number of first-time prisoners in these data, it is likely that these individuals were incarcerated under drug-related mandatory minimum sentencing laws. In addition to drug offenders, almost 30% of the sample was incarcerated for a violent crime, and 19% of the sample committed a property crime. The final 18% of the sample was incarcerated for a public-order or other offense.

3.2.3.2 In-Prison Experiences

Time served measures the length of the focal imprisonment in years. This variable captures all time between the admission and release dates. Unlike a judicial sentence,

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[19] It is unclear whether a divorced inmate can report single as his or her marital status. If so, this number may not solely reflect those never-married, but a composite of never-married and divorced inmates.
[20] Drug offenders are overrepresented in this sample. Nationally, on average roughly 15% of prisoners are incarcerated for a drug offense (Carson, 2018). The larger portion of drug offenses could result from the sampling restriction that excludes individuals who maxed out their prison sentence and were released without supervision. If these individuals were not drug offenders, the same distribution may more closely mirror national estimates. However, it is also possible that a larger portion of drug offenders are observed due to how PA classifies their commitment offense. The commitment offense is top-coded based on the most serious conviction charge. If mandatory minimum sentences are considered the more serious charge, this could mean that offenders who committed a drug offense in addition to other crimes are only labeled as drug offenders, resulting in a disproportionately large number of drug offenders.

time served accounts for discretionary parole release. On average, inmates in the sample spent 2.38 years in prison prior to release (SD=2.63). While in prison, PA inmates are classified into five custody levels, ranging from least to most restrictive. An inmate's *custody level* was measured with an interval scale of one to five, with five representing the most restrictive custody level. The modal custody level at intake is three, which represents medium custody. Custody designations can change over the course a prison term. To account for these changes a weighted average is created to capture the proportion of the prison term served at each custody level. On average, inmates score 2.611 (SD=0.608), meaning that they spent the majority of their prison term on custody level two or three (minimum and medium custody).

For descriptive purposes, misconduct events occurring during the prison term were measured in three ways. First, *any misconduct* is a binary variable capturing whether inmate was found guilty of any misconduct incident during the focal imprisonment. Roughly 60% of inmates in the sample were found guilty of a misconduct incident. Second *the rate of guilty misconduct incidents* per year incarcerated was generated by taking the total number of guilty misconduct incidents divided by years incarcerated (or time served). On average, inmates commit 1.95 misconducts per year during the focal imprisonment (SD=3.52). Third, dummy variables capturing the *type of misconduct* were generated for violent, drug, property, and rule violations incidents. Misconduct incidents were classified into these groups according to PA DOC categorization scheme. About 14% of the sample was found guilty of at least one misconduct, 24% were guilty of a property misconduct, 7% had at least one guilty drug incident, and 45% were found guilty of a rule violation.

In addition to misconduct incidents the sanctioning of these events was considered. In PA, the most common response to a rule violation is a stay in disciplinary custody (Browne et al., 2015). To capture segregation as a punishment, the proportion of imprisonment term spent in segregation, is measured as the total number of days in *disciplinary custody* divided by the number of days incarcerated. On average, inmate spend 0.131 days per year incarcerated in disciplinary custody (SD=1.52), however less than 30% the sample experienced any disciplinary custody during the focal prison term.

During imprisonment, inmates can participate in a voluntary or mandatory programming. To capture program participation during the prison term, all prison programs were categorized into groups depending on the content of the program. Dichotomous indicators were generated to reflect whether an inmate participated in a program of particular content. Program categories include 1) *drug and alcohol treatment*, 2) *cognitive behavioral theory*, 3) *anger-management*, 4) individual or group *counseling*, 5) *education*, 6) *employment training*, 7) *reentry planning*, 8) *parenting classes*, 9) *violence prevention,* 10) *misconduct free* living, and 11) *sex-offender programming*.

Over 80% of inmates participated in at least one program during the focal prison term. Of the programs offered, the most common programs were rehabilitative in nature. More than sixty-percent of inmates received some form of drug treatment while incarcerated either in the form of methadone maintenance, a 12-step program, or removal from the general inmate population and placement in a therapeutic community. Several inmates also participated in violence prevention training (40.6% of inmates) or cognitive behavior therapy (33.4%). Additionally, almost 14% of the sample received either

individual or group counseling at some point during the prison term, and another 5% receive anger management therapy.

Skills based programs, designed to prepare inmates to reenter the community were, on average, less popular. Only 3% of inmates received employment or work related training, roughly 10% took parenting classes. Fifteen-percent received in-prison education. Twenty-percent of inmates received reentry preparation in addition to the standard planning offered. Finally, roughly 4% percent of inmates participated in sex-offender therapy or programming of some kind.

3.2.3.3 Parole Supervision

Parole supervision begins when a parolee is released from a PA prison and continues until his or her maximum sentence date is reached. On average, individuals in this sample remained on parole supervision for 3.9 years (SD=4.18 years). Due to outlier values and a heavy right skew, *parole length* was top-coded at the 99th percentile at 60 years.

Upon release parolees are classified into one of three initial parole *supervision levels*: minimum, medium, or maximum supervision (Pennsylvania Board of Probation and Parole, 2014). Regardless of supervision level, all parolees must abide be a standard set of conditions that prohibit the commission of a new crime or owning a firearm, and require periodic drug testing, check-ins with parole officers, and restitution payments (Pennsylvania Board of Probation and Parole, 2016). In addition to standard parole conditions, supervision levels dictate the amount of contact a parolee has with his or her parole officer. Forty-percent of the sample was released to minimum parole supervision. *Minimum supervision* is the least restrictive on the parolee, requiring only one face-to-

face meeting or home-visit with a parole officer per three-month interval. *Medium supervision* entails one face to face meeting per month or one home visit per month. Approximately 40% of parolees were released to medium supervision. Finally, 19% of parolees were released on *maximum supervision*, requiring two meetings with a parole officer per month (Pennsylvania Board of Probation and Parole, 2014).

Finally, a binary indicator of whether the parolee was released to a halfway house was included as a control variable. Halfway houses are residential facilities operated by the PA DOC that provide housing, employment services, treatment, and meals to ex-inmates. Inmates may leave the premises during the day but must abide by a strict curfew and return for frequent drug testing. Approximately 53% of parolees were released to a halfway house following the focal imprisonment.

3.3. Analyses

The goal of this dissertation is to determine the extent to which imprisonment serves as a positive and/or negative turning point in the criminal career. In addition, I assess whether repeated exposure or the timing of imprisonment influence the if a positive, negative, or non-turning point is observed. In pursuit of these goals, this dissertation contains four stages of analyses. In stage 1, separate dual trajectory models are employed in the first-time and repeat prisoner samples. This involved estimating pre- and post-prison trajectory models separately, selecting the appropriate number of groups, and calculating the transitions between trajectory groups. Stage 2 involved classifying each transition between trajectory groups as indicative of positive, negative, or non-turning points. The percentage of cases in which there was evidence of a positive or negative turning point were compared across the first-time and repeat-prisoner samples,

as a descriptive assessment of cumulative disadvantage and repeated exposure to imprisonment. In the third stage, the dual trajectory approach was implemented in the full sample, and the transitions between the resulting trajectory groups were classified as reflective of positive, negative, or non-turning points. In stage 4, multinomial logistic regressions identified the correlates of transitions deemed positive turning points and negative turning points. Three separate multinomial regressions were estimated in each of the samples (full sample, first-time prisoners, and repeat prisoners, respectively). In each regression, I focused primarily on if and how number of prior imprisonment and age relate to positive and negative turning points, as a way to appraise the life course principles of cumulative disadvantage and timing. Each of the four stages and estimation strategies is outlined in more detail below.

3.3.1 Traditional Group Based Trajectory Modeling

Group based trajectory modeling (GBTM) is an application of finite mixture modeling that estimates longitudinal patterns of behavior. GBTM can be thought of as a data reduction technique that concisely describes the complexities of longitudinal data by identifying clusters of observations that exhibit similar patterns of an outcome measured over time (or trajectories). GBTM captures the progress of behavior as it unfolds over time, leading many social scientists to use this method as a way to model developmental change. Unlike other models used to estimate longitudinal patterns of behavior, for instance hierarchal linear modeling or latent growth curve modeling, GBTM does not assume a continuous distribution of potential trajectories in the population. Instead, it assumes that a population is comprised of a discrete number of groups with distinct developmental pathways. GBTM estimates both the shape and level of each group's

pathway, and the proportion of the population comprising each group. To do so, the following likelihood function is utilized:

$$P(Y_i) = \sum_{j}^{J} \pi_j P^j(Y_i)$$

where Y_i is the vector of outcomes for each individual, J is the total number of groups estimated, j is a specific group, and π_j is the proportion of the population that group j comprises. Thus, the outcome is a composite of the group specific trends, $P^j(Y_i)$, weighted by the size of the group in the population.

GBTM estimates the outcome variable in each time period (Y_{it}) as a polynomial function of age or time for a pre-determined number of groups. The present study estimates trajectories as a function of time before or after prison using logistic regressions. Pre- and post-prison criminal trajectories were estimated using the following equation

$$y_{it}^j = \frac{e^{\beta_0^j + \beta_1^j Time_{it} + \beta_2^j Time^2_{it} + \beta_3^j Time^3_{it}}}{1 + e^{\beta_0^j + \beta_1^j Time_{it} + \beta_2^j Time^2_{it} + \beta_3^j Time^3_{it}}}$$

where y_{it}^j is the probability that $y_{it}=1$ (observing an arrest or recidivism event) given membership in group j, $Time_{it}$ is a six month interval in the four years before and after prison, and β_m^j are group specific coefficients governing changes in the probability of criminal behavior. Unique coefficients for each of the J groups are calculated using maximum likelihood estimation. In the above equation, the trajectory groups were given cubic functional form to allow for two potential changes in the direction of criminal behavior the observation period. Given what is known about crime over the life course (Hirschi & Gottfredson, 1983; Sampson & Laub, 1993) a cubic order polynomial is

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sufficiently flexible for estimating criminal behavior in a four-year period. Unless stated otherwise in the results, all models were estimated with cubic order. However, not all models converged with a cubic specification and fit statistics revealed that a quadratic order was preferred in some cases.

Once the trajectory patterns are estimated, individual observations are assigned to a trajectory group. Bayesian statistics generate posterior probabilities of group membership (PPGM) that reflect the likelihood that individual i belongs in group j given the individual's outcome vector. PPGM for each group are calculated using the following formula:

$$\hat{P}(j|Y_i) = \frac{\hat{P}(j|Y_i)\hat{\pi}_j}{\sum_j^J \hat{P}(j|Y_i)\hat{\pi}_j}$$

where j is the group, and $\hat{\pi}_j$ is the estimated proportion of group j in the population (Nagin, 2005). A PPGM for each trajectory group are calculated for each observation. These probabilities sum to 1. Observations are then assigned to the trajectory group with the highest PPGM, meaning they are sorted into the group with the average trajectory pattern most similar to their own behavior. It is important to note that assignment to trajectory groups is probabilistic. Individuals do not definitively belong to trajectory groups, but are classified with uncertainty. For ease of interpretation, scholars may name to the trajectory groups based on their level or pattern of behavior (e.g. high chronic offenders or desisters), but this does not mean that any observation assigned to that group follows the average trajectory pattern. In addition, the groups and trajectory patterns are products of the estimation procedure. They may not be considered "real" classes of offenders. Risk of group reification must be tempered with acknowledgement that the groups are an approximation of heterogeneity in the outcome of interest.

3.3.2. Dual Trajectory Analysis

A dual trajectory model is a simple extension of traditional GBTM. Instead of modeling unique patterns of a single outcome, the dual model simultaneously estimates trajectories for two related outcomes and calculates the statistical relationship between them. The two outcomes estimated in a dual trajectory model can occur simultaneously or in separate time periods (Nagin, 2005; Nagin et al., 2008). For example, Nagin (2005) uses a dual trajectory model to estimate the relationship between number of sexual partners is adolescence and adolescent violence, contemporaneous outcomes, while Eggleston-Doherty, Laub and Sampson (2009) use the model to assess juvenile incarceration history and adult crime.

In the present study, implementing the dual trajectory approach involved modeling criminal behavior before and after prison. The first outcome (Y_1) captures the probability of arrest in the four years prior to prison, and the second (Y_2) represents the probability of recidivism in the four years following release. As noted above, the pre- and post-prison time periods are divided into six month intervals, so the trajectories reflect patterns in probability of arrest or recidivism in each six month period leading up to and following the focal imprisonment, resulting in eight intervals in each trajectory model.

To conduct the dual analysis, the two outcomes of interest were first estimated in separate trajectory models to determine the optimal number of groups for each outcome (pre prison arrests and post-prison recidivism). Selecting a final model is a subjective task because the researcher must specify the appropriate number of groups in the final model and their order (Nagin, 2005). To reduce subjectivity in model selection, GBTM

models were estimated for each outcome systematically, beginning with one group and adding groups until the models failed to converge. To differentiate between models and select the appropriate number of groups, I considered multiple model fit statistics including the Bayesian Information Criterion (BIC), the average posterior probability (AvePP), and the odds of correct classification (OCC) (Nagin, 2005; Tahamont et al., 2015).

The most common metric used in model selection is the BIC. The BIC is based on the model's maximized likelihood and the number of parameters estimated. A penalty term reduces BIC scores when more parameters are added, such that a more parsimonious model should be preferred unless the added parameters increase explanatory power. Models with larger BIC scores are considered superior. Though the BIC is the most common fit statistic in GBTM studies, it is not considered reliable with large samples. The BIC often indicates model improvement with additional groups or parameters, even if the new group adds no substantive value or if classification error increases. As such, two group level fit statistics were considered to supplement the BIC.

The group average posterior probabilities (AvePP$_j$) are the average posterior probability of group membership (PPGM) for observations classified to group j based on the maximum probability classification rule. The AvePP within a group quantifies classification accuracy: higher AvePP values signify better classification of observations. On average, all groups in a model should have AvePP values that exceed 0.7, indicating that there is less than a 30% chance on average that observations are classified improperly (Nagin, 2005).

The second group level fit statistic is the odds of correct classification (OCC_j). The OCC_j are given by the following formula:

$$OCC_j = \frac{\frac{AvePP_j}{1 - AvePP_j}}{\frac{\pi_j}{1 - \pi_j}}$$

To calculate the OCC_j the $AvePP_j$ is scaled by the group size (π_j). Considering group size is important because PPGM tend to be higher for large groups. Higher OCC_js represent greater confidence that observations were classified into the optimal groups, accounting for group size. In practice, the OCC for each group should exceed 5.0 to indicate adequate classification (Nagin, 2005).

In addition to BIC, $AvePP_j$, and OCC_j, group size and the substantive difference between groups were also considered in model selection. Models with multiple small groups, comprising less than 5% of the sample are considered inferior (Nagin, 2005). Further, when the addition of a group simply reproduces the pattern of an existing group without much change in the outcome level (intercept), it does not add to the overall description of the data, and a more parsimonious model was preferred. All model selection procedures are documented and justified when reporting results in Chapter 4.

Once the appropriate number of pre- and post-prison trajectory groups were selected, the dual model estimated both arrest and recidivism trajectories, and calculated the relationship between the pre- and post-prison trajectory groups. The likelihood function for the dual trajectory model is given by

$$P(Y_1, Y_2) = \sum_j \pi_j f^j(Y_1) \sum_k \pi_{k|j} h^k(Y_2)$$

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where Y_1 is the pre-prison arrest probability, j is the pre-prison trajectory group, $f^j(Y_1)$ is the function governing the pre-prison trajectory pattern for each group, and π_j is the estimated proportion of the population following each pre-prison trajectory. In the second term, Y_2 is the post-prison probability of recidivism, k is the post-prison trajectory group, $h^k(Y_2)$ is the polynomial function specifying the post-prison trajectories, and $\pi_{k|j}$ is the conditional probability of membership in a post-prison group, given membership in a pre-prison trajectory group.

The dual trajectory model provided three important outputs (Nagin et al., 2008). First, the model provided group-specific parameters defining the criminal trajectories in both the pre- and post-prison time periods, and estimated the proportion of the population in each trajectory group. These parameters determine the intercept and shape of each group's trajectory in the four years leading up to or following imprisonment. Second, posterior probabilities of group assignment for each individual for each of the outcomes were estimated, allowing for classification into trajectory groups on both outcomes. Finally, the model estimated series of probabilities linking pre- and post-prison trajectories. These probabilities include conditional and joint probabilities of group membership in each of the pre- and post-prison trajectory groups. In the current context, the transition probabilities of interest reflect the likelihood of being in a post-prison trajectory group, conditional on the pre-prison pattern. These probabilities reflect how individuals transition between pre- and post-prison trajectories. Depending on how each transition is classified, joint probabilities indicated the likelihood of observing specific types of turning points in the criminal career.

Three dual trajectory models were estimated in fulfillment of the research objectives. To assess cumulative disadvantage and repeated exposure to imprisonment, separate dual trajectory models including first-time prisoners and repeat prisoners were estimated and compared. The transitions for each sample were classified as positive, negative, or non-turning points (i.e., behavioral continuity) and the relative prevalence of positive, negative, and no behavioral change in each sample was considered. A third dual trajectory model was employed with the full sample[21]. Following the classification of transitions as indicating positive, negative, or non turning points, multinomial logistic regressions determine the correlates of each type of transition, and specifically whether number of prior imprisonments and age at admission to prison relate to each type of turning point. Post-estimation regressions provided a way to assess cumulative disadvantage, as well as the timing of imprisonment. Each procedure is described below.

3.3.3. Defining Transitions as Turning Points

The dual trajectory model provides an analytic framework to assess changes within a criminal trajectory. Though an individual only has one criminal trajectory throughout the life course, estimating pieces of that trajectory in distinct time frames provides one way to discern whether the two patterns are distinct, and by extension, can indicate if there is a change in the overall pathway that suggests a turning point. To be clear, this strategy does not involve directly modeling imprisonment as a turning point. If the two trajectories are indistinguishable, or one is simply a continuation of the other, there may not be a change in the overall pattern, and no turning point should be inferred.

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[21] The main analysis employed a four-year pre-prison trajectory period and included inmates imprisoned at or after age 22. The observation period in the pre-prison trajectory models was also shortened to incorporate younger individuals. Dual trajectory models with a two- and three-year pre-prison observation period were estimated to include inmates entering imprisonment at ages 20 and 21 respectively. The results of these sensitivity analyses are documented in Appendix A.

If the pre- and post-prison trajectories suggest discontinuity in level or direction of criminal behavior before and after prison, then it may be inferred that prison served as a turning point in the criminal career because it is an event occurring between distinct trajectories of criminal behavior.

Nagin and colleagues (2008) utilized the dual trajectory approach to measure grade retention, substance use, and gang entry as turning points in aggression and violence. After the childhood aggression and adolescent violence trajectories were estimated, they used multinomial logistic regressions to determine if dichotomous indicators of life events proposed to be turning points significantly predicted transitions between trajectory groups. If so, they inferred a that the life event (e.g. substance use) was a turning point. Their analysis implies that any transition between trajectory groups is indicative of turning points.

The present study offers an alternative way to measure turning points with a dual trajectory model. Here, transitions between trajectory groups in the pre- and post-prison time frames were classified as reflecting a positive turning point, negative turning point, or no turning point based on their narrative character. These classifications were dependent on multiple criteria: 1) the estimated arrest probability in the period prior to imprisonment relative to the estimated recidivism probability in the first post-prison time periods, 2) the increasing or decreasing pattern observed in both trajectories, and 3) the average proportion of time on the street (exposure time) for each group. The first criterion indicates whether there is a discontinuity in the probability of criminal behavior before and after imprisonment. Discontinuity was assessed by comparing the group average probability of arrest or recidivism across the four-year pre- and post-prison

periods. and by considering how the predicted arrest probability in the six months prior to prison compared to the predicted probability of recidivism in the post-prison period. These comparisons allow for an assessment of whether the probability of criminal behavior changes and whether there was a discrete jump (or change) in arrest and recidivism at the time of imprisonment.

The second criterion captured whether there was an escalation or decline in criminal behavior before and after imprisonment. Consider an example. In many cases, recidivism studies demonstrate that the recidivism hazard declines with time since release from prison, and this declining risk of recidivism is interpreted as evidence of desistance from crime (e.g., Blumstein & Nakamura, 2009; Kurlychek et al., 2006). While it might be the case that offenders do desist after prison, these studies do not consider how the declining pattern relates to the pre-prison offending pattern. Therefore, they do not rule out the possibility that the observed decline was part of a pre-existing trend. Imagine now that criminal behavior escalated prior to imprisonment, such that the probability of arrest increases in the 18 months preceding imprisonment, but upon release the probability of arrest steadily declines. These patterns together would be suggestive of a change in the offending pattern, because the prior behavioral trend is deflected. In order to determine whether imprisonment is a turning point in the criminal career, the pre- and post-prison trajectory patterns were considered in tandem. A descriptive account of the pre- and post-prison trajectory pattern determines whether there is a change in the pattern of offending before and after prison.

The third criterion was the amount of time individuals were in the community during in the pre- and post-prison periods (e.g., at risk of arrest or recidivism). It is

possible that a declining trajectory is observed because the likelihood of arrest drops, but it is also possible to see an artificial decline if individuals are incarcerated and therefore incapacitated. By considering the average exposure time for each group, I avoided inferring turning points (particularly positive turning points) when the likelihood of arrest changes because of time on the street. Caution was exercised in classifying transition as turning points when there was evidence that incarceration obscured the trajectory patterns observed. If it appeared that the trajectory pattern may reflect incapacitation rather than real changes in behavior, a transition was not deemed indicative of a turning point.

These three criteria were considered collectively to determine whether a turning point occurred, however when classifying each transition, these three criteria did not always provide a consistent picture of whether the transition should be deemed a positive or a negative turning point. For example, in some cases the average probability of arrest was higher in the pre-prison period than the post-prison period, but the estimated probability of recidivism immediately following release from prison was higher than in the 6 months immediately preceding imprisonment. When these inconsistencies emerged, discretion was used to determine whether a specific transition was deemed a turning point. These choices are thoroughly documented in Chapter 4. In general, the necessary and sufficient criteria for determining a turning point occurred are as follows: A discrete increase or decrease in the probability of arrest and recidivism exceeding 0.10 (e.g. a 10% increase in the probability of criminal behavior) or a change in the average probability of arrest and recidivism exceeding 0.2 were considered sufficient evidence of a turning point in this study. With respect to inferring positive turning points, it was necessary that no more than 30% of a trajectory period was spent incarcerated when a

declining pattern was observed in the post-prison period. This condition was imposed to avoid inferring a positive turning point when changes in criminal behavior could be due to incapacitation.

Based on these criteria, it is possible to categorize a transition as a negative turning point even though the post-prison trajectory pattern exhibits a declining slope. Here, turning points are inferred when the total offending appears to increase across the four years, regardless of the slope. Without a longer follow up period it is not possible to know whether these declines sustained and were part of a desistance process, or whether offending would again increase. For this reason, if the probability of recidivism in each post-prison period is higher than the probability of arrest in all or most pre-prison periods, amplification occurred despite the declining probability of recidivism following release from prison.

3.3.4. Post-Estimation Methods

Although it is descriptively interesting to model pre- and post-prison criminal behavior and discern discontinuity that is suggestive of a turning point, the purpose of this study is to assess cumulative disadvantage and timing in turning points. To do so, multivariate post-estimation regressions determined whether prior imprisonments and age at admission to prison were statistically associated with transitions classified as turning points. The dependent variable in these models was a categorical measure of the transition between trajectory groups, capturing whether the transition is categorized as reflecting a positive turning point, a negative turning point, or no turning point. The multinomial logistic regressions estimated the relative odds of observing different transitions (e.g. odds of observing a transition classified as positive turning point

compared to non-turning point) and demonstrated how prior prison terms and age at admission to prison change those odds. To consider the possibility that offending discontinuity is contingent upon the timing of first or repeated imprisonments, separate multinomial logistic regression were also estimated on the transitions generated by the dual trajectory models utilizing the first-time and repeat prisoner samples.

The multivariate multinomial logistic regression with covariates (x_i) is specified by the following equation:

$$p_{(y=j)} = \frac{e^{\sum_{k=1}^{k} \beta_{jk} x_k}}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=1}^{k} \beta_{jk} x_k}} \ \ for \ j = 1, 2, ..., J\text{-}1$$

where j indicates the response category or categorical value of the dependent variable (e.g. positive turning point group) and k subscripts each x variable or covariate included in the model (Liao, 1994). Here, all transitions classified as positive turning points, negative turning points, and non-turning points are grouped together and given one of three j values. Covariates in X_i included prior prison terms, age at admission, and the control variables outlined in Section 3.3. It should be noted that separate coefficients are estimated for each response category. As such, the impact of each covariate is group specific, allowing the relationships of interest to differ depending on the groups compared. This means that the relationship between age and the likelihood of observing a positive turning point relative to no turning point is not restricted to be the same as the relationship between age and the likelihood of observing a negative turning point relative to no turning point. Each multinomial coefficient represents the change in odds of observing a transition associated with a change in the variable (relative to the base category). Each odds ratio has an associated standard error and p-value indicating statistically significant associations.

These post-estimation regressions served three purposes. First, they provided a direct test of this study's hypotheses. For example, a statistically significant relationship between age at admission to prison and a transition to a post-prison trajectory (or turning points) would suggest that the timing of imprisonment matters. If this coefficient is negative, and the transition under inspection is suggestive of a negative turning point, then the analyses would suggest that as age increases, the likelihood of experiencing a negative turning point decreases, indicating that experiencing imprisonment earlier in the life course is associated with amplified offending, supporting hypothesis 3.

Second, the addition of control variables reduced bias in estimating the relationships between the prior imprisonments, age and offending changes (transitions). Including these control variables increased the precision with which hypotheses 2-4 are evaluated by reducing omitted variables. Third, these models determined which inmate characteristics, prison experiences, and parole experiences independently distinguish positive, negative, and non-turning points. Though not a main focus of this dissertation, these relationships are descriptively interesting and allow for an additional assessment of heterogeneity in turning points.

The transition probabilities serving as dependent variables in the multinomial logits are a product of the dual trajectory estimation process. Using estimated quantities as dependent variables introduces uncertainty and potential measurement error arising from two sources: 1) error inherent to classifying observations into trajectory groups and 2) error in estimating the dual trajectory model. Although group assignment is probabilistic, the multinomial logistic regression treats group membership as if it is certain, because observations are hard classified into transitions based in their pre- and

post-prison trajectory groups. Failure to account for this uncertainty biases standard errors. To account for classification error, posterior probabilities of group assignment were added as weights to the multinomial logistic regressions so that observations contribute to the results proportional to their classification accuracy. Adding these weights corrects for bias generated by classification error but does not correct for error associated with estimating the dual trajectory model. To handle the latter issue, Sweeten (2014) recommends a resampling design. I bootstrapped the standard errors in all multinomial logistic regression using 500 repetitions, to adjust for uncertainty into the modeling process. In Stata 14 it is not possible to use weights and bootstrap in the same model. As such, in Chapter 4, the regression results are reported for a weighted regression and bootstrapped regression (with 500 replications) separately.

The dual trajectory approach serves as only one way to study imprisonment as a potential turning point in the criminal career. Indeed, other work in this area has focused mostly on the effect of imprisonment on crime a variety of identification strategies, which, in some respects can be viewed as evidence of a turning point. Estimating dual trajectory models and defining transitions as turning points or not depending on the character and level of offending patterns observed in the pre- and post-prison periods offers a more descriptive assessment of whether imprisonment can be a turning point. This method can supplement what is already known about prison and crime, or parole and crime, by describing the progression of offending before and after prison and identifying cases in which there is a discontinuity in the overarching pathway. When evidence of a turning point is observed, post-trajectory regression models reveal the

significant correlates of both positive and negative turning points and provide some context as to whom and under what conditions each type of discontinuity is observed.

CHAPTER 4: RESULTS

4.1. A Description of the Imprisonment Experience for this Sample

Before discussing whether there is evidence that imprisonment serves as a turning point in the criminal career, or whether cumulative disadvantage and timing of imprisonment distinguish positive and/or negative turning points, it is worthwhile to understand the nature of the imprisonment experience for this sample (i.e. define the treatment), given that heterogeneity in prison and parole experiences are well documented. Discussions of heterogeneity in prison and parole experiences often center on state-level differences or changes experience over time, potentially because this is thought to be where the largest disparities are observed (for reviews, see Bahr et al., 2010; Haney, 2002; Mears et al., 2015; Tahamont & Frisch, forthcoming). Here, it is important to understand how the imprisonment experience differs for individuals incarcerated in the same state and released in the same three-year period. Unpacking differences in the imprisonment experience provides context for the discussion of whether imprisonment is a turning point, and may provide insight as to why certain patterns are observed.

Tables 2A-2D contain descriptive statistics illustrating the imprisonment experience for individuals of different imprisonment history, gender, ages, and race/ethnicity. Non-parametric rank sum tests were performed to determine whether differences across demographic groups are statistically significant. Unlike a t-test which compares mean values, rank-sum tests demonstrate whether there is a statistically significant difference in the values of a variable across different groups, making no parametric assumptions. Below I focus on the significant differences that emerge when

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comparing the experiences of first time and repeat prisoners (*Table 2A*), males and females (*Table 2B*), individuals of different ages (*Table 2C*), and individuals of different racial/ethnic groups (*Table 2D).*

Table 2A. Descriptive Statistics of the Prison and Parole Experiences for First-Time and Repeat Prisoners

	Imprisonment History		
	First-Time Prisoners N=13,155	**Repeat Prisoners** N=11,737	Sig.
Time Served (Years)	2.654 (2.960)	1.997 (2.144)	**
Custody Score	2.599 (0.620)	2.535 (0.565)	**
Any Misconduct (0/1)	0.495 (0.499)	0.693 (0.461)	**
Misconduct Rate (Per Year)	0.770 (1.191)	3.280 (4.623)	**
Misconduct Type			
Violent	0.099 (0.299)	0.184 (0.462)	*
Property	0.170 (0.376)	0.310 (0.463)	*
Drug	0.049 (0.215)	0.096 (0.295)	*
Other	0.360 (0.480)	0.549 (0.497)	*
Any Disciplinary Custody (0/1)	0.242 (0.428)	0.400 (0.490)	**
Disciplinary Custody Rate (Days/Year)	0.036 (0.307)	0.239 (2.195)	**
Any Programs (0/1)	0.837 (0.370)	0.782 (0.413)	*
Program Type (0/1)			
Drug/Alcohol	0.621 (0.485)	0.595 (0.491)	*
Cognitive Behavioral Therapy	0.308 (0.462)	0.322 (0.467)	
Anger Management	0.031 (0.172)	0.069 (0.253)	*
Counseling	0.107 (0.309)	0.164 (0.370)	*
Education	0.134 (0.340)	0.172 (0.377)	*
Employment Training	0.017 (0.130)	0.053 (0.224)	*
Reentry Planning	0.126 (0.331)	0.250 (0.433)	*
Parenting	0.102 (0.302)	0.087 (0.282)	*
Violence Prevention	0.358 (0.479)	0.398 (0.489)	*
Misconduct-Free Living	0.018 (0.133)	0.059 (0.236)	*
Sex Offender	0.048 (0.213)	0.025 (0.157)	*
Parole Length (Years)	3.651 (3.412)	3.341 (3.527)	*
Initial Parole Supervision Level (0/1)			
Minimum	0.400 (0.490)	0.376 (0.484)	
Medium	0.208 (0.406)	0.183 (0.368)	*
Maximum	0.207 (0.494)	0.115 (0.318)	**
Halfway House (0/1)	0.541 (0.498)	0.513 (0.499)	**

**p<0.01, *p<0.05. Note: (0/1) indicates the variable is measured dichotomously.

Table 2A contains the descriptive statistics for variables capturing the prison and parole experiences of first time prisoners and repeat prisoners. On average, first-timers serve longer sentences than repeat prisoners ($\bar{X}$= 2.65 years (SD=2.96 years) and 1.997 (SD=2.144 years)) respectively, $p<0.01$). It is possible that repeat prisoners are re-incarcerated due to parole violations, meaning that time served is shorter because the inmate only returns to prison to serve part of the original sentence. Not only do first time prisoners serve longer sentences in prison, they also spend slightly more time on parole supervision. On average, first time prisoners spend 3.651 years on parole supervision (SD= 3.412 years) while repeat prisoners spend only 3.341 years on parole (SD=3.353 years). Upon release, a significantly greater proportion of first time inmates are initially supervised on medium and maximum supervision than repeat prisoners ($p<0.05$). No significant difference emerges when comparing the portion of each sample assigned to minimum supervision.

While in prison, first time inmates are more likely to be housed at lower custody levels, and spend a greater proportion of their sentence in lower custody units. First time inmates also commit significantly less misconduct, in that 50% of first-time inmates engage in at least one misconduct incident, compared to nearly 70% of repeat prisoners ($p<0.01$). On average first-time inmates commit less than one misconduct incidents per year (SD= 1.19) while repeat prisoners average almost 3.5 misconduct incidents per year (SD=4.62). Repeat prisoners are almost twice as likely to engage in violent and drug related incidents, and commit more property offenses in prison than first-time prisoners ($p<0.05$). Not surprisingly, then, 40% of repeat inmates spend time in disciplinary custody, compared to only 24% of first-time prisoners.

First-time inmates are significantly more likely than repeat prisoners to participate in at least one program while incarcerated, but a close look at the distribution of inmates in programs of varying content reveals some important differences. Repeat prisoners are significantly more likely to participate in counseling (16.4% vs. 10.7%), education (17.2% vs. 13.4%), employment training (5.3% vs. 1.7%), the misconduct-free living program (5.9% vs. 1.8%), violence prevention (40% vs. 36%) and reentry planning (25% vs. 12.6%) ($p < 0.05$). Insofar as repeated imprisonment signifies greater risk of future offending, this pattern is consistent with a Risk-Need-Responsivity (RNR) approach to correctional management, wherein the highest risk inmates are provided (or mandated) the greatest level of services (Andrews & Bonta, 2006; Cullen, 2013). Excluding educational and employment programming, the programs that repeat prisoners are more likely to engage in are traditionally mandated by prison officials rather than volunteer-based. This suggests that repeaters do not seek rehabilitative opportunities but are required to participate in mandatory programming.

Table 2B: Descriptive Statistics for the Prison and Parole Experiences of Males and Females

	Gender		
	Male N=22,723	**Female** N=2,169	**Sig.**
Time Served (Years)	2.405 (2.693)	1.760 (1.800)	**
Custody Score	2.598 (0.593)	2.267 (0.561)	**
Any Misconduct (0/1)	0.605 (0.488)	0.457 (0.498)	**
Misconduct Rate (Incidents/Year)	2.024 (3.586)	1.126 (2.631)	**
Misconduct Type (0/1)			
Violent	0.141 (0.347)	0.121 (0.326)	*
Property	0.241 (0.427)	0.174 (0.380)	
Drug	0.075 (0.263)	0.035 (0.185)	**
Other	0.459 (0.498)	0.338 (0.473)	
Any Disciplinary Custody (0/1)	0.327 (0.469)	0.205 (0.404)	**
Disciplinary Custody (Days/Year)	0.140 (1.596)	0.045 (0.278)	**
Any Programs (0/1)	0.812 (0.391)	0.799 (0.401)	
Program Type (0/1)			
Drug/Alcohol	0.615 (0.486)	0.543 (0.498)	**
Cognitive Behavioral Therapy	0.320 (0.467)	0.258 (0.438)	**
Anger Management	0.053 (0.224)	0.002 (0.042)	**
Counseling	0.133 (0.340)	0.134 (0.340)	
Education	0.151 (0.358)	0.127 (0.333)	*
Employment Training	0.033 (0.179)	0.037 (0.190)	
Reentry Planning	0.192 (0.394)	0.089 (0.286)	**
Parenting	0.078 (0.269)	0.267 (0.442)	**
Violence Prevention	0.395 (0.489)	0.222 (0.416)	**
Misconduct-Free Living	0.037 (0.188)	0.041 (0.199)	
Sex Offender	0.040 (0.196)	0.006 (0.076)	**
Parole Length (Years)	3.569 (3.515)	2.964 (2.875)	**
Initial Parole Supervision Level (0/1)			
Minimum	0.387 (0.487)	0.412 (0.492)	*
Medium	0.296 (0.397)	0.197 (0.398)	
Maximum	0.202 (0.401)	0.160 (0.366)	**
Halfway House (0/1)	0.531 (0.499)	0.507 (0.500)	*

**p<0.01, *p<0.05

Note: (0/1) indicates a variable is measured dichotomously.

Table 2B documents heterogeneity in the imprisonment experience by gender. In general, the imprisonment experience is harsher for males. Females serve substantially shorter sentences than males and are housed in lower custody levels (p<0.01). With

respect to parole, males are more likely to be released to maximum supervision (p<0.01), and less likely to be released to minimum supervision compared to females (p<0.05). Female inmates also spend less time on parole, on average (p<0.01).

Females are 15% less likely to engage in misconduct and participate in misconduct at a much lower rate than males ($\bar{X}$= 1.840 (SD=4.566) and $\bar{X}$= 3.972 (SD=12.443) for females and males respectively, p<0.01). The distribution of misconduct types is roughly comparable, with the exception that males are more likely to engage in violent and drug-related incidents (p<0.05 and p<0.01, respectively). Males also spend more time in disciplinary custody. Thirty-two percent of male inmates were sentence to disciplinary custody at least once during the focal imprisonment, compared to only 21% of female inmates (p<0.01). Moreover, males spend almost three-times as many days per years in segregation as females (p<0.01).

Though males and females are equally likely to participate in programs, the types of programs they each participate in varies. Males are significantly more likely than females to participate in drug/alcohol treatment (61.5% vs. 54.3%), cognitive behavioral therapy (32% vs. 26%), anger management (5% vs. less than 1%), reentry planning (19.2% vs. 9%), violence prevention (39.5% vs. 22.2%), and sex offender programming (4% vs. less than 1%) (p<0.01). Females, on the other hand, are more likely to take parenting classes (26.7% vs. 7.8%) (p<0.01). Because PA prisons are gender-segregated, these patterns could partly reflect differences in program availability at male and female institutions.

Table 2C: Descriptive Statistics for Prison and Parole Experiences for Inmates Admitted to Prison at Different Ages

	Age at Admission				
	22-25 N=3,901	**26-30** N=5,894	**31-40** N=9,000	**41+** N=6,097	*Sig. (22 - 25 vs. Older)*
Time Served (Years)	2.74 (2.96)	2.48 (2.94)	2.35 (2.60)	2.03 (2.10)	**
Custody Score	2.84 (0.63)	2.71 (0.57)	2.56 (0.54)	2.29 (0.31)	**
Any Misconduct (0/1)	0.67 (0.47)	0.67 (0.47)	0.59 (0.49)	0.46 (0.50)	**
Misconduct Rate (Incidents/Year)	1.90 (2.53)	2.35 (3.88)	2.11 (3.70)	1.40 (3.07)	
Misconduct Type (0/1)					
Violent	0.18 (0.38)	0.17 (0.37)	0.15 (0.35)	0.08 (0.28)	**
Property	0.29 (0.45)	0.29 (0.45)	0.24 (0.43)	0.15 (0.36)	**
Drug	0.08 (0.26)	0.09 (0.29)	0.07 (0.26)	0.05 (0.22)	
Other	0.54 (0.49)	0.52 (0.49)	0.46 (0.50)	0.32 (0.47)	*
Any Disciplinary Custody (0/1)	0.38 (0.49)	0.37 (0.48)	0.33 (0.47)	0.21 (0.41)	**
Disciplinary Custody (Days/Year)	0.10 (0.64)	0.20 (1.69)	0.15 (2.12)	0.06 (0.48)	
Any Programs	0.87 (0.34)	0.85 (0.36)	0.81 (0.40)	0.74 (0.44)	**
Program Type					
Drug/Alcohol Treatment	0.66 (0.47)	0.64 (0.48)	0.61 (0.49)	0.55 (0.50)	**
Cognitive Behavioral Therapy	0.41 (0.49)	0.36 (0.48)	0.30 (0.46)	0.23 (0.41)	**
Anger Management	0.06 (0.23)	0.06 (0.24)	0.05 (0.22)	0.03 (0.17)	**
Counseling	0.16 (0.36)	0.15 (0.36)	0.13 (0.34)	0.10 (0.30)	**
Education	0.16 (0.37)	0.15 (0.36)	0.16 (0.35)	0.14 (0.34)	
Employment Training	0.03 (0.16)	0.04 (0.20)	0.04 (0.19)	0.03 (0.17)	*
Reentry Planning	0.18 (0.38)	0.20 (0.40)	0.20 (0.40)	0.15 (0.36)	
Parenting	0.12 (0.32)	0.13 (0.33)	0.01 (0.30)	0.04 (0.19)	**
Violence Prevention	0.51 (0.50)	0.42 (0.49)	0.36 (0.48)	0.28 (0.44)	**
Misconduct-Free Living	0.03 (0.16)	0.04 (0.21)	0.04 (0.20)	0.03 (0.19)	
Sex Offender	0.04 (0.18)	0.03 (0.18)	0.04 (0.20)	0.03 (0.19)	
Parole Length (Years)	3.84 (3.74)	3.63 (3.51)	3.59 (3.60)	3.15 (3.08)	**
Initial Parole Supervision Level (0/1)					
Minimum	0.42 (0.49)	0.39 (0.49)	0.39 (0.49)	0.36 (0.48)	**
Medium	0.22 (0.42)	0.21 (0.49)	0.19 (0.39)	0.17 (0.38)	**
Maximum	0.18 (0.38)	0.16 (0.37)	0.16 (0.36)	0.17 (0.37)	*
Halfway House (0/1)	0.55 (0.50)	0.521 (0.50)	0.53 (0.450)	0.53 (0.50)	

**p<0.01, *p<0.05

Note: (0/1) indicates the variable is measured dichotomously.

Table 2C contains the mean values for the prison and parole experience variables, disaggregated by inmate age at admission to prison. The rank sum test reported in the last column reveals whether there is a difference between individuals in the first age category, ages 22-25, relative to the remaining sample of older inmates. This age range was selected because it represents emerging adulthood, which is a theoretically relevant age category in the present study.

In general, *Table 2C* suggests that there is a general in the "harshness" of the imprisonment experience with age at admission. Time served, parole length, the proportion of inmates sent to disciplinary custody, custody score, and initial parole supervision level gradually decline with age. In addition, while in prison, the likelihood of engaging in misconduct decreases after age 30, and inmates ages 22-25 are significantly more likely to engage in at least one misconduct relative to the rest of the sample ($p<0.01$). Interestingly, though the prevalence of all misconduct types declines with age, drug misconduct is greatest among inmates imprisoned between the ages of 26 and 30.

With respect to programming, participation in almost all program types declines with age. Only 74% of inmates entering prison at age 41 or older participated in at least one program during their sentence, while roughly 87% of inmates 22-25 participated in some form of programming. Although the prevalence of programming may decrease with age, this does not necessarily indicate that younger inmates choose more programs. Inmate ages 22-25 are more likely to participate in drug and alcohol treatment, cognitive behavioral therapy, violence prevention, and counseling programs ($p<0.01$), many of which may be mandated by the prison itself.

Table 2D. Descriptive Statistics for Prison and Parole Experiences for Inmates of Varying Race/Ethnicity

	Race/ Ethnicity [1]							
	White N=9,969	Sig	**Black** N=11,787	Sig	**Hispanic** N=3,008	Sig	**Other** N=128	Sig
Time Served (Years)	2.115 (2.461)		2.540 (2.858)	**	2.347 (2.144)	**	3.034 (2.842)	**
Custody Score	2.510 (0.593)		2.620 (0.602)	**	2.568 (0.554)		2.491 (0.589)	*
Any Misconduct (0/1)	0.537 (0.499)		0.634 (0.482)	**	0.610 (0.488)	*	0.579 (0.494)	
Misconduct Rate (Incidents/Year)	1.606 (3.109)	**	2.281 (3.839)	*	1.828 (3.392)		1.750 (3.243)	
Misconduct Type (0/1) Violent	0.090 (0.371)		0.178 (0.383)	**	0.154 (0.361)		0.218 (0.415)	**
Property	0.201 (0.401)		0.267 (0.442)	**	0.248 (0.431)		0.313 (0.465)	*
Drug	0.074 (0.261)		0.071 (0.257)		0.069 (0.254)		0.078 (0.269)	
Other	0.368 (0.482)	**	0.525 (0.499)	**	0.459 (0.498)		0.469 (0.499)	
Any Disciplinary Custody (0/1)	0.244 (0.429)	**	0.378 (0.485)	**	0.316 (0.465)		0.328 (0.471)	
Disciplinary Custody (Days/Year)	0.102 (1.196)		0.155 (1.828)	**	0.141 (1.199)		0.121 (0.748)	
Any Programs (0/1)	0.813 (0.390)	**	0.799 (0.401)	**	0.851 (0.356)	**	0.820 (0.385)	
Program Type (0/1) Drug/Alcohol	0.643 (0.479)	**	0.566 (0.496)	**	0.666 (0.472)	**	0.508 (0.502)	
CBT	0.269 (0.444)	**	0.351 (0.477)	**	0.325 (0.468)		0.289 (0.455)	*
Anger Management	0.043 (0.202)	** **	0.053 (0.225)	**	0.048 (0.213)		0.031 (0.175)	
Counseling	0.125 (0.331)		0.140 (0.347)	**	0.134 (0.341)		0.125 (0.332)	*
Education	0.136 (0.342)	**	0.159 (0.366)	**	0.161 (0.367)	*	0.103 (0.307)	
Employment	0.028 (0.165)	*	0.038 (0.192)	**	0.034 (0.180)		0.070 (0.257)	
Reentry Planning	0.175 (0.380)	* **	0.190 (0.392)	*	0.188 (0.391)	**	0.164 (0.372)	*
Parenting	0.088 (0.279)		0.101 (0.302)	* **	0.101 (0.302)		0.125 (0.332)	
Violence Prevention	0.349 (0.477)	**	0.401 (0.490)		0.395 (0.489)	**	0.398 (0.492)	
Misconduct-	0.030	**	0.043		0.039		0.070	

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		Sig		Sig		Sig		Sig
Free Living	(0.169)		(0.202)		(0.194)		(0.257)	
Sex Offender	0.052		0.029	**	0.021		0.039	
	(0.211)		(0.167)		(0.142)		(0.195)	
Parole Length (Years)	3.349	**	3.631	**	3.572	**	4.554	*
	(3.300)		(3.604)		(3.353)		(5.351)	
Initial Parole Supervision Level (0/1)								
Minimum	0.403	*	0.373		0.402		0.359	
	(0.491)		(0.484)		(0.490)		(0.482)	
Medium	0.209	*	0.190		0.184	*	0.125	
	(0.406)		(0.392)		(0.388)		(0.332)	
Maximum	0.194		0.140	**	0.151	*	0.180	*
	(0.395)		(0.347)		(0.359)		(0.385)	
Halfway House (0/1)	0.485	**	0.556	**	0.579	**	0.411	**
	(0.499)		(0.497)		(0.494)		(0.494)	

1. All significance tests capture differences between the specific racial/ethnic group and to the rest of the sample (e.g., column 3 reports significant differences between whites and all other inmates)

**p<0.01, *p<0.05. Note: (0/1) indicates the variable is measured dichotomously

Finally, *Table 2D* contains the mean values of each prison and parole variable for White, Black, Hispanic, and Other race inmates. Rank sum tests were performed comparing the values of each racial or ethnic group to the rest of the sample. These results are reported in the columns labeled "Sig" to the right of each racial/ethnic group.

The prison experience varies somewhat by race and ethnicity. The most differences emerge when comparing White inmates to the rest of the sample and Black inmates to the rest of the sample. Significant differences emerge on almost every measure for these two groups. *Table 2D* indicates that Black and Hispanic inmates spend more time both in prison and on parole supervision than the rest of the sample; they are also housed at higher custody levels. This suggests that these groups experience "harsher" conditions in prison and on parole than other inmates. Moreover, on average, 54% of white inmates are found guilty of at least one misconduct incident during the focal imprisonment, compared to 63% of Black and 61% of Hispanic inmates respectively. Black and Hispanic inmates are more likely to engage in both violent and property

offenses in prison, and Black inmates are over represented in common rule violations. Relative to the rest of the sample, Black inmates are more likely to experience disciplinary custody, and spend more days per year in segregation (p<0.01) This finding corroborates research documenting racial and ethnic disparities in punishment and imprisonment (for a review see Mitchell, 2005; Travis et al., 2014; Walker et al., 2007).

With respect to in-prison programming, 85% percent of Hispanic inmates participate in some type of programming while imprisoned, compared to only 81% and 80% of White and Black inmates, respectively. White and Hispanic inmates are more likely to engage in programs relative the rest of the sample, while black inmates are significantly less likely to engage in any programs. Looking more closely at program types reveal what White inmates are less likely than Black and Hispanic inmates to participate in educational programs, cognitive behavioral therapy, and violence prevention (p<0.01).

The outlying group is the "other race" category, which includes Asian inmates, Native American Indian inmates, and inmates categorized as other racial or ethnic groups. Inmates categorized as other race serve longer sentences ($\bar{X}$=3.034 (SD=2.842), p<0.01) but are classified to lower custody levels (p<0.05). Relative to the rest of the sample, a greater proportion of other race inmates engages in at least one violent misconduct incident (p<0.01) or one property misconduct incident (p<0.05). In terms of programming, other-race inmates are most likely to have employment based training but least to participate in educational programs. Inmates categorized as other race also serve the longest parole sentences (p<0.01), but are least likely to be released to a halfway house (p<0.01).

Clearly the imprisonment experience is heterogeneous in the sense that there are many dimensions to consider, but as *Tables 2A-2D* demonstrate, prison and parole experience also vary markedly across demographic groups. Even when inmates are incarcerated in the same state, at the same time, the imprisonment experience can look quite different in terms of time served both in prison and on parole, the severity of the experience (e.g. custody level or parole supervision level), inmate behavior and the institutional responses to that behavior, and program participation. In the analyses to follow, I determine whether imprisonment serves as a turning point in the criminal career and identify sources of heterogeneity in how imprisonment relates to changes in criminal trajectories (e.g. treatment effect heterogeneity). I do not measure imprisonment directly and by extension, I treat imprisonment a homogenous experience occurring between two statistical trajectories. Although the evidence presented above suggests that this is not the case, considering the extent to which there is heterogeneity provides an important backdrop to the analysis. The implications of this choice are considered in Chapter 6.

Now that the "treatment" is understood, the results for this analysis are presented in three stages. Recall that this research seeks to determine whether imprisonment is a turning point in the criminal career, and whether cumulative disadvantage or the timing of imprisonment condition the changes in criminal trajectories before and after prison. Toward answering these questions, first, the results of two dual trajectory models are presented for first-time prisoners and repeat prisoners separately. For each sample, the transitions between trajectory groups were classified as reflecting positive, negative, or no turning points. The prevalence of positive and negative turning points was then compared for the two samples to determine if the distribution of positive and negative

turning points differ for first-time and repeat prisoners (Section 4.2). This comparison provides a descriptive assessment of whether repeated exposure to imprisonment relates to positive and negative turning points, which may indirectly capture cumulative disadvantage. A second assessment of cumulative disadvantage involved estimating the dual trajectory model with the full sample and using the number of prior prison stays as a predictor of transitions that suggest either positive or negative turning points with multinomial logistic regressions (Section 4.3). To investigate the timing of imprisonment, age at admission to prison is used as a predictor of positive and negative turning points in the full sample (Section 4.4). Finally, the multinomial logistic regressions are estimated with the transitions derived from the trajectory analyses in stage one (Section 4.2) to determine whether age at admission to prison is differentially associated with positive and negative turning points among first time and repeat prisoners (Section 4.5).

4.2 Investigating Cumulative Disadvantage and Repeated Exposure to Imprisonment

These data contain 13,155 first time prisoners who were incarcerated in a PA prison at or after age 22 and released onto parole supervision between 2006 and 2008. This is the analytic sample for the first iteration of the dual trajectory model. In presenting these results, I first discuss the trajectory estimations and model selection for pre-prison arrest and post-prison recidivism trajectories. Then, I review the transitions between pre- and post-prison trajectory groups. Finally, each transition is categorized as reflecting either a positive turning point, negative turning point, or no turning point.

4.2.1. Pre-Prison Trajectories of First Time Prisoners

A review of the descriptive statistics regarding pre-prison arrests provides an important context for the pre-prison trajectories. *Table 3* contains the average probability of arrest among first time prisoners in the four years prior to prison. The probability of arrest generally increases as the time to imprisonment decreases, ranging from just under 0.20 four years prior to first imprisonment and peaking at almost 0.50 between six and twelve months before prison. The probability of arrest declines in the six months immediately preceding imprisonment, potentially because these figures exclude the arrest that led to imprisonment[22] or because some individuals were jailed during the time of their trial.

Table 3. Probability of Arrest in Each Pre-Prison Trajectory Period for First-Time Prisoners

Trajectory Period	Probability of Arrest
3.5 to 4.0 Years Before Prison	0.1816
3.0 to 3.5 Years Before Prison	0.1858
2.5 to 3.0 Years Before Prison	0.1919
2.0 to 2.5 Years Before Prison	0.2926
1.5 to 2.0 Years Before Prison	0.2482
1.0 to 1.5 Years Before Prison	0.3365
0.5 to 1.0 Years Before Prison	0.4820
0.0-to 0.5 Years Before Prison	0.2620

Table 4 shows the number of six month intervals, or trajectory periods, in which an individual was arrested in the four years prior to prison. Roughly 3.31% of first time prisoners were arrested only once prior to first imprisonment. Because the commitment

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[22] All pre-prison arrest figures exclude the arrest that lead to the imprisonment. Because arrest is a necessary condition of imprisonment, almost all individuals are arrested in the year prior to the focal imprisonment. As such the probability of arrest increases to 1 in the year preceding imprisonment for all observations, and regardless of the number of groups the trajectory patterns observed all reach 1 at the end of the prison period. The trajectory model has difficulty distinguishing observations when this occurs. For this reason, the pre-prison trajectories are estimated using all pre-prison arrests excluding the arrest that led to imprisonment.

arrest was excluded from the analysis, these individuals are observed as having zero pre-prison arrests. This group is more likely than the rest of the sample to have been arrested for a violent (26% vs. 22%, $p<0.05$)[23] or drug crime (37% vs 24%, $p<0.001$). It is possible that the imposition of a mandatory minimum sentencing law led to the first imprisonment for these individuals, or simply that they committed more serious offenses.

Table 4. Count of Pre-Prison Trajectory Periods in which at least One Arrest Occurred-First Time Prisoners

Number of Trajectory Periods with Any Arrest	Frequency	Percentage	Cumulative Percentage
0	435	3.31%	3.31%
1	4,797	36.47%	39.77%
2	3,754	28.54%	68.31%
3	2,539	17.93%	86.24%
4	1,158	8.80%	95.04%
5	466	3.54%	98.59%
6	145	1.10%	99.69%
7	41	0.31%	100.00%

The majority of first time prisoners are arrested in two or fewer pre-prison periods (68.31%). Another 18% of individuals were only arrested in three of the eight pre-prison time periods. Not a single first time prisoner was arrested in all eight intervals prior to prison. Lack of variability in pre-prison arrests could be a function of the sampling restriction, that individuals imprisoned at or after age 22 are generally not very active prior to prison (though research suggests that this is not always the case—see Tahamont et al., 2015). It is also possible that individuals were jailed or incarcerated in another setting prior to their first stay in a PA prison. The arrest statistics in *Table 4* are comprised of arrests made by Pennsylvania State Police and do not include out of state

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[23] Rank sum tests were performed to assess significant differences between individuals with and without more than one pre-prison arrest.

arrests or arrests made by the FBI. Moreover, *Table 4* does not account for time spent in

jail or incarceration in another state. Low variability in levels of criminal activity before

prison could also be a product of the incompleteness of official criminal records.

Regardless, because the trajectory procedure identifies distinct patterns of variation in

arrest, lack of variability in the likelihood of arrest in the four years prior to prison results

in the identification of fewer trajectory groups.

　　　　Table 5 contains the fit statistics for the pre-prison trajectory models, estimated

with a logistic regression and quadratic order. In the pre-prison period, trajectory models

converged up to four groups. Although the trajectory models converged up to four

groups, the fit statistics in *Table 5* indicate that the two-group model is the best

specification.

Table 5. Model Fit Statistics for Pre-Prison Trajectories for First Time Prisoners

	One Group	Two Groups	Three Groups	Four Groups
BIC	-58601.67	-58143.36	-57913.68	-57502.79
AvePP$_j$				
Group 1 (%)	1.0	0.9555(64.32%)	0.7823 (47.52%)	0.8872 (53.50%)
Group 2 (%)	---	0.7508 (35.79%)	0.7909 (50.77%)	0.6516 (32.52%)
Group 3 (%)	---	--	0.6180 (1.99%)	0.7090 (13.36%)
Group 4 (%)	---	--	---	0.6675 (0.06%)
OCC$_j$				
Group 1	--	11.909	3.967	6.836
Group 2	---	5.405	3.667	3.880
Group 3	---	---	79.565	15.805
Group 4	---	---	---	323.342

　　　　When comparing trajectory solutions with differing number of groups, the most

common metric used in model selection is the Bayesian Information Criterion (BIC).

Models with higher Bayesian Information Criterion (BIC) scores are considered superior to other models. As mentioned in Chapter 3, the BIC is based on the model's maximized likelihood and the number of parameters estimated. A penalty term reduces BIC scores when more parameters are added, such that in most cases. In the case of trajectory analysis, parameters are estimated for each group, so the penalty term gets larger as more groups are added. Although the BIC incorporates a penalty parameter, Nagin (2005) notes that like in the case of standard regression, where adding variables only increases R-squared, the same is true for GBTM. Especially in large samples, models with more groups are typically have larger BIC because the parameter penalty does not offset the increase in log-likelihood as groups are added.

The problems associated with only considering BIC scores is apparent in *Table 5*. Despite fact that the Bayesian Information Criterion (BIC) increases with the addition of a third and fourth group, the group level-fit statistics and group sizes demonstrate poorer fit as the number of groups increase. For instance, the threshold level of group-level Average Posterior Probabilities (AvePP$_j$) is 0.7. Only the two-group model meets this threshold. The same is true for the odds of correct classification (OCC$_j$), which has a threshold value of 5.0. These metrics serve as evidence of classification error in the three and four group models. The addition of a third or fourth group also results in the emergence of a very small group, which is are an indicator of poor model (Nagin, 2005). Though these fit statistics are useful, model selection should not be based entirely on quantitative metrics, and the substantive value of additional groups in describing heterogeneity in the data should also be considered (Nagin, 2005). In both the three- and four-group solutions the presence of an additional group simply replicates an existing

trajectory pattern, with a slightly different intercept value. Although adding more groups may improve the BIC score, the classification error and lack of substantive value of the third and fourth groups suggests that the two-group solution is the best pre-prison trajectory model for first-time prisoners.

Figure 1. Pre-Prison Trajectories for First-Time Prisoners
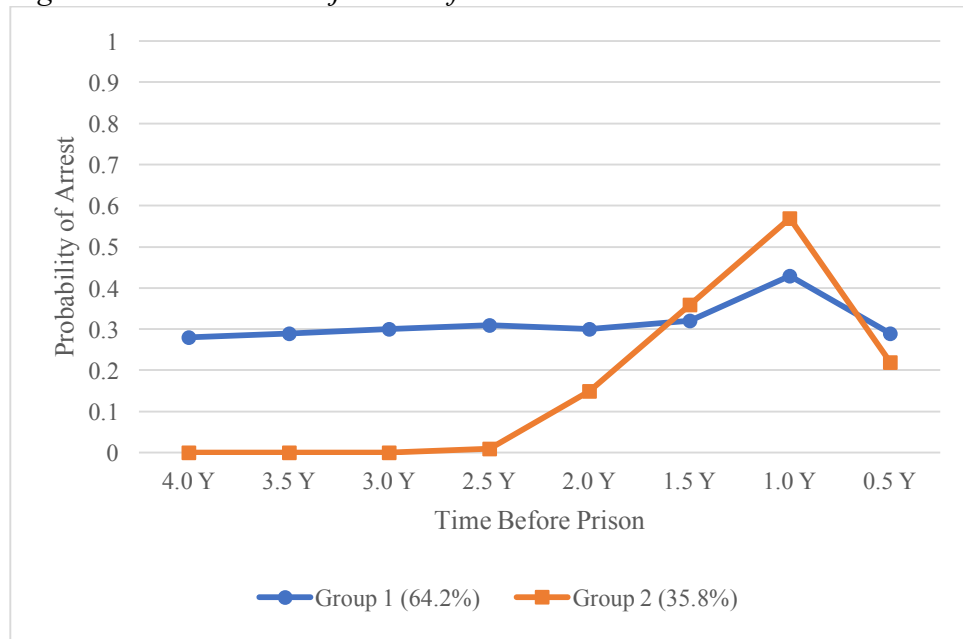
Figure 1 graphically depicts the two-group solution of pre-prison trajectories for first time prisoners. The graph reveals that 64.2% of the sample is classified into moderate, relatively stable group, with a probability of arrest averaging 0.3 in the four years prior to prison (Group 1). Group 1 contains all individuals with arrests in three or more pre-prison periods, indicating that this group was arrested frequently in the four years prior to imprisonment. Group 2, by contrast, is not arrested until the two years prior to prison. The probability of arrest increases from zero beginning two years prior to prison, and peaks at 0.6 in the 6-12 months preceding imprisonment. Group 2 contains all individuals with only zero or one arrest (excluding the commitment offense) prior to

imprisonment. The spike in the probability of arrest is generated by the individuals with a single arrest (excluding the commitment arrest), which is likely to occur in the 6-12 months prior to prison. Compared to Group 1, Group 2 is the low activity group in the pre-prison period. In this model, classification error arises from individuals with arrests in two pre-prison periods, whom are classified into both trajectory groups. Still, the fit statistics and substantive description of the groups suggest that the two-group solution most appropriately describes heterogeneity in pre-prison among first-time prisoners.

4.2.2 Post Prison Trajectories for First-Time Prisoners

Descriptive statistics for post-prison criminal behavior are provided in *Tables 6 and 7*. *Table 6* displays the probability of arrest or re-incarceration (hereafter collectively referred to as recidivism) in each of the eight post-prison trajectory periods. First-time prisoners exhibit low levels of criminal activity following release from prison. The probability of recidivism is low in each post-prison period, never exceeding 0.2. For first time prisoners, the probability of arrest declines steadily as time since release increases, ranging from 19% to 10% over the four-year period. This declining pattern is consistent with most recidivism studies using official data (see Beck & Shipley, 1997; Durose et al., 2015; Kaeble & Bonczar, 2015; Langan & Levin, 2002).

Table 6. Probability of Recidivism in each Post-Prison Trajectory Period for First-Time Prisoners

Trajectory Period	Probability of Arrest
0.0 to 0.5 Years After Prison	0.1567
0.5 to 1.0 Years After Prison	0.1887
1.0 to 1.5 Years After Prison	0.1649
1.5 to 2.0 Years After Prison	0.1475
2.0 to 2.5 Years After Prison	0.1348
2.5 to 3.0 Years After Prison	0.1249
3.0 to 3.5 Years After Prison	0.1087
3.5 to 4.0 Years After Prison	0.1054

Table 7 displays the number of post-prison periods in which first time prisoners experience at least one recidivism event. The largest portion of first time prisoners do not recidivate in the four years after prison. Almost forty-three percent of first-time prisoners have no officially recorded arrest or re-imprisonment in the state of PA. Though slightly higher than other estimates of recidivism among first-time prisoner[24], these data are consistent with empirical evidence suggesting that first-time prisoners are less likely recidivate than repeat prisoners (Hughes et al., 2001; Rosenfeld et al., 2005; Tonry, 2004). Descriptive statistics presented in *Table 2A* demonstrate that first-time prisoners spend more time on parole supervision than repeat prisoners. Therefore, it is possible first time prisoners recidivate less if they are deterred by the imprisonment experience or by post-release supervision.

Table 7. Count of Post-Prison Trajectory Periods with at least one Recidivism Event—First Time Prisoners

Number of Post-Prison Periods with Recidivism Event	Frequency	Percentage	Cumulative Percentage
0	5,597	42.55%	42.55%
1	3,201	24.33%	66.88%
2	2,561	19.13%	86.01%
3	1,165	8.86%	94.86%
4	448	3.41%	98.27%
5	167	1.27%	99.54%
6	49	0.37%	99.91%
7	10	0.08%	99.98%
8	2	0.02%	100.00%

Like the pre-prison observation period, a large portion (almost 95%) of first-time prisoners recidivate in three or fewer post-prison periods. Of the first-time prisoners who

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[24] Other estimates of recidivism measure recidivism only as re-incarceration, which could account for some of the discrepancy here. In this sample, 51% of first-time prisoners are re-incarcerated within four years of release from prison, a proportion slightly higher than previously documented.

do recidivate in the four years following release, 24.33% recidivate in only one post-prison period and 19.13% recidivate in two periods. Infrequent offending in the post-prison period may be a function of exposure time—or the amount of time a parolee is in the community and at risk of arrest or re-incarceration. *Table 8* contains the average proportion of each post-prison period in which a first-time prisoner is in the community (not incarcerated in state prison). Exposure time is calculated as the ratio of days not imprisoned in each trajectory period, divided by the total number days, therefore representing the proportion of each post-prison trajectory period that was not spent incarcerated in a PA state prison. Quantities closer to 1 represent more time on the street, whereas quantities closer to 0 represent more time imprisoned in a trajectory period.

Table 8. Average Proportion of Time Spent on the Street following Release- First Time Prisoners

Time Period	Average Proportion of Time on the Street
0.0 to 0.5 Years After Release	0.9561
0.5 to 1.0 Years After Release	0.8790
1.0 to 1.5 Years After Release	0.8339
1.5 to 2.0 Years After Release	0.8244
2.0 to 2.5 Years After Release	0.8319
2.5 to 3.0 Years After Release	0.8369
3.0 to 3.5 Years After Release	0.8474
3.5 to 4.0 Years After Release	0.8536

For first-time prisoners, average exposure time decreases in the first two years following release from prison. After two years, the proportion of time spent in the street increases slightly, but does not return to initial levels. This pattern suggests that re-incarceration in state prison occurs shortly after release from prison (within a two-year period). After two years, re-imprisonment either becomes less likely or individuals are re-released into a community setting. Still, the overall proportion of time spent on the street

is high for first-time prisoners. On average, less than 20% of each post-prison period is spent incarcerated in a state prison.

In the post-prison period, the trajectory models with first-time prisoners converged up to five groups. Each model is estimated with quadratic order groups, allowing for a single inflection point in the trajectory over the four-year post prison period. Each model also contains a zero-order group, which forces one trajectory group to be flat. This group was included because a large portion of first-time prisoners do not recidivate (*Table 7*). None of the post-prison models account for exposure time, or time in the community following release from prison. The addition of an exposure covariate to the trajectory models increased classification error and presented convergence issues. As such, average exposure time is considered qualitatively as a post-classification descriptive statistic to characterize each trajectory group. The role of exposure time in criminal trajectories is explored thoroughly in *Appendix B*.

Table 9. Post-Prison Trajectory Model Fit Statistics for First-Time Prisoners

	One Group	Two Groups	Three Groups	Four Groups	Five Groups
BIC		-41388.75	-41343.02	-41215.54	-41216.37
AvePP$_i$					
Group 1 (%)	1.0	0.8453 (47.29%)	0.6801 (28.91%)	0.6683 (28.38%)	0.7152 (30.42%)
Group 2 (%)	---	0.8302 (42.71%)	0.9330 (65.67%)	0.5725 (14.57%)	0.7927 (50.80%)
Group 3 (%)	---	--	0.7193 (5.42%)	0.7826 (46.07%)	0.6142 (11.27%)
Group 4 (%)	---	--	---	0.7099 (10.97%)	0.5103 (1.32%)
Group 5 (%)	---	---	---	---	0.6961 (6.19%)
OCC$_j$					
Group 1	--	6.089	5.243	5.084	5.744
Group 2	---	6.561	7.275	7.852	3.705
Group 3	---	---	44.746	4.213	12.532
Group 4	---	---	---	19.854	78.154
Group 5	---	---	---	---	34.718

Table 9 contains the fit statistics for each post-prison trajectory solution. Generally speaking, model fit declines as more than three groups were added, as indicated by reductions in the average posterior probability of group membership and odds of correct classification for each group in *Table 9*. The two-group model is the only specification that is adequate according to the metrics set forth by Nagin (2005), but the three-group solution is only slightly under the advised thresholds. Both solutions are considered.

Figure 2. Two-Group Solution for Post-Prison Trajectories for First Time Prisoners
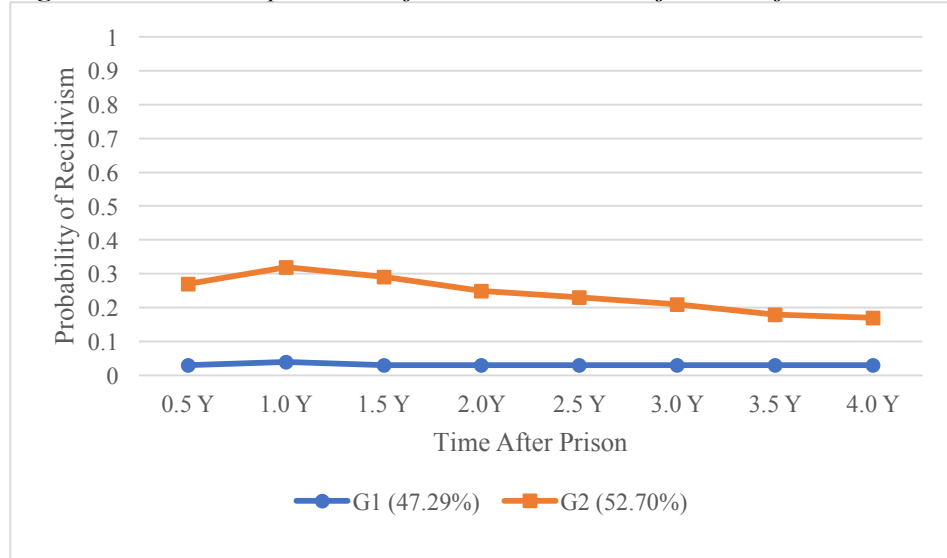
Figure 2 illustrates the two-group post-prison trajectory solution for first-time prisoners. The two-group model contains one flat trajectory, with low, stable probability of recidivism in the four years following release from prison. Group 1 contains roughly 47% of first-time prisoners, including all individuals with zero recidivism events. The second group, roughly 53% of first time prisoners, is marked by a moderate declining trajectory, with 30% chance of recidivism immediately following release that steadily declines to 15% after four years.

Figure 3. Three-Group Solution for Post-Prison Trajectories for First-Time Prisoners
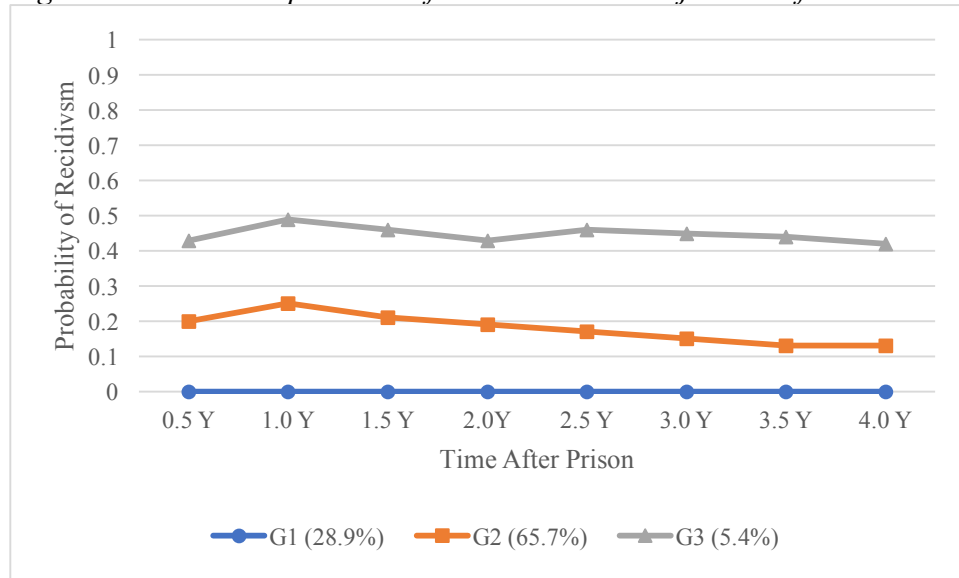
Figure 3 contains the three-group post-prison solution for first time prisoners. This solution contains two relatively stable trajectories, a non-recidivating group at zero and a high chronic group with a probability of arrest ranging from 0.42 to 0.49 in the four years following release. Roughly 29% of first time prisoners are classified into a zero-group, with no probability of recidivism in the four years following release. This group contains only individuals with 0 recidivism events in the four-year period, suggesting appropriate model fit. The second group looks remarkably similar to Group 2 in the two-group specification. The middle group comprises the largest portion of the population, and is characterized by a moderate, declining probability of recidivism. Group 3 is characterized by a high, stable probability of recidivism (0.41) across the follow up period. This group is small, comprising just over 5% of first time prisoners. All first-time prisoners classified into the high stable group recidivated in three or more post-prison trajectory periods.

Both the two- and three-group solutions are adequate according to the model fit statistics set forth by Nagin (2005). Although the three-group model has one group with

an AvePP slightly below the threshold of 0.7, this threshold is largely arbitrary, and an AvePP of 0.681 is very close to the recommended standard. The OCC for this group surpasses 5.0, suggesting classification accuracy of the three-group model is reasonable. It becomes necessary to select a model based on the substantive value of the third, high stable trajectory group. The presence of a high chronic offending group in the four years following prison seems both plausible and substantively important. Disproportionality in criminal offending is well documented. For example, Wolfgang and colleagues (1972) identified a high, chronic offending group that comprises roughly 6% of the sample in the Philadelphia Birth Cohort Study. Moffitt (1993) similarly predicts a group of high chronic offenders, comprising a small portion of the population. Considering the number of post-prison periods in which a recidivism event is observed for this group confirms that individuals sorted into the high stable group are in fact recidivating multiple times in the four-year observation window. For this reason, I select the three-group solution.

Recall that this model does not account for exposure time, so the trajectories reflect the unconditional probability of recidivism in the four years following release from the first imprisonment. Recidivism differences observed between trajectory groups may be a function of time on the street. To consider this possibility *Table 10* displays the group-specific average exposure in each of the post-prison periods.

Table 10. Post-Prison Exposure for First-Time Prisoners, by Trajectory Group

Years after Release from Prison	Group 1 Average Proportion of Time on Street	Group 2 Average Proportion of Time on Street	Group 3 Average Proportion of Time on Street
0.0 to 0.5 Years	0.9984	0.9291	0.8222
0.5 to 1.0 Years	0.9994	0.7951	0.6720
1.0 to 1.5 Years	0.9996	0.7131	0.6734
1.5 to 2.0 Years	0.9999	0.6927	0.7444
2.0 to 2.5 Years	0.9999	0.7040	0.7970
2.5 to 3.0 Years	0.9998	0.7107	0.8571
3.0 to 3.5 Years	1.0	0.7283	0.8880
3.5 to 4.0 Years	1.0	0.7399	0.8787

The second column of *Tale 10* reveals that individuals classified in Group 1, the stable non-offending group, remained recidivism free despite almost complete exposure in the four years following release. On average, less than 1% of each post-prison period was spent incarcerated., suggesting that non-offending does not result from incapacitation. For individuals in Group 2, on average, more than 80% of the first year after release is spent in the community, but exposure time declines thereafter. On average, roughly 30% of the post prison period is spent incarcerated in a PA state prison between 18 months and 4 years after release. This is also when the probability of recidivism appears to decline. Thus, the low, declining probability of recidivism observed for Group 2 could be a function of time spent incarcerated.

The last column of *Table 10* contains exposure time for the high stable trajectory group. If incarcerated, this group is likely to be readmitted to a PA prison early in the follow up period. After the first 18 months, average exposure time remains above 75%. It is possible that the high rates of recidivism observed for this group is a function of more time on the street.

4.2.3 Transitions Between Pre- and Post-Prison Trajectories for First-Time Prisoners

   With the pre- and post-prison trajectory models selected for the first-time prisoner sample, the dual trajectory model allows for investigation of conditional group membership, or transitions from pre- to post-prison offending patterns. These transitions are used to determine whether there is evidence suggesting prison serves as a turning point. *Figure 4* depicts these transitions, along with the probability of membership in a post-prison trajectory, conditional on the pre-prison trajectory group. The first column contains the pre-prison trajectory. The second column contains a graph of all post-prison trajectories, and the proportion of individuals in the pre-prison trajectory group that transitions to each post-prison group is marked in the legend of the graph. Transitions are first described, and then categorized as positive, negative, or non-turning points.

Figure 4. Probabilities of Transitioning from the Two Pre-Prison Trajectories to all Three Post-Prison Trajectories for First-Time Prisoners

Group 2 (35.8%)

Pr(G1post|G2pre) = 0.523
Pr(G2post|G2pre)=0.465
Pr(G3post|G2pre)=0.012
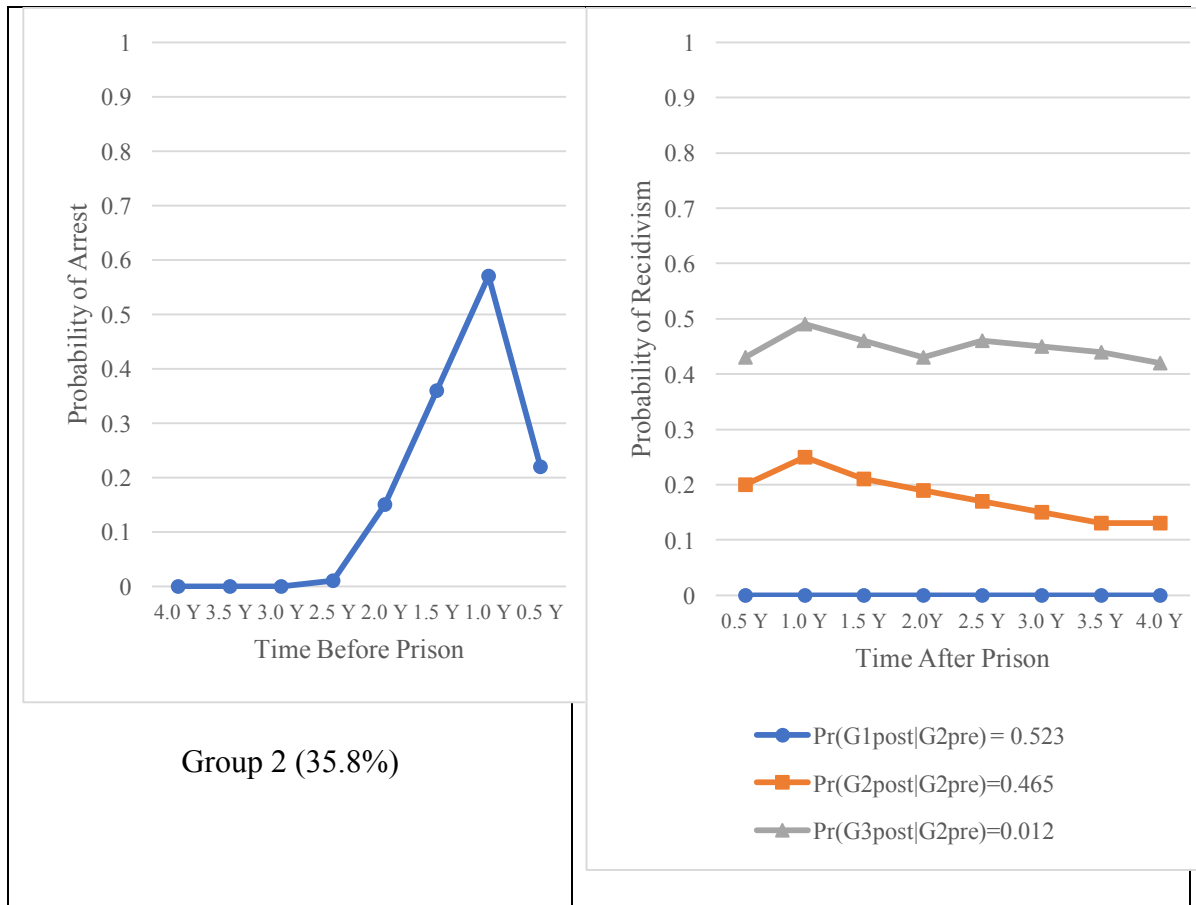
The first panel of Figure 4 shows the transitions from Group 1 in the pre-prison period to each of the post-prison trajectory groups. Conditional on membership in the moderate stable pre-prison group (Group 1), the most likely transition is to the second post-prison group, marked by a moderate, declining probability of recidivism. The likelihood of transitioning to a non-offending post-prison trajectory is 0.346. The probability of transitioning to the high stable post-prison group from Group 1 prior to prison is just 0.03. This is the least likely outcome, partly because Group 3 in the post-prison period is the smallest group, comprising only five percent of the first-time prisoner sample.

Recall that the second pre-prison trajectory group is the low activity group, characterized by no arrests two to four years prior to prison and an increasing probability of arrest only in the two years prior to prison. Conditional on membership in the second pre-prison group, the most likely outcome is transitioning to the non-offending post-prison group. The probability of transitioning to a non-offending post-prison trajectory of 0.52 for the second pre-prison group, which is substantially greater than individuals in the first pre-prison group. With a transition probability of 0.012, individuals in Group 2 prior to prison are less than half as likely to transition to the high stable post prison group relative to individuals in the first pre-prison group.

Though the transitions between pre- and post-prison groups are descriptively interesting, each transition must be categorized as emblematic of positive or negative turning points, depending on whether there is discontinuity in arrests and recidivism before and after prison. To do so, objective criteria or quantitative metrics can be used to distinguish pre- and post-prison trajectories. One plausible method for discerning whether a turning point occurred is to compare the estimated probability of criminal activity (arrest or recidivism) in the last pre-prison period to the estimated probability in the first post-prison period. This method assesses discontinuity in offending by determining whether there is a discrete jump in the probability of arrest and recidivism before and after prison. It is also possible to compare the average probability of criminal behavior (arrest or recidivism) across the entire pre- and post-prison periods. These metrics alone, however, does not utilize the full value of the trajectory method. By using only an estimate from a single time-period before and after prison or considering the average probability, the progression of offending over time is not captured and behavior over four

years is reduced to a single number. As such, qualitative descriptions of the pre- and post-prison criminal behavior, and an assessment of exposure time, are also considered. Descriptions of each transition are provided below.

In transition 1 (Group 1 Post-Prison & Group 1 Pre-Prison) individuals move from a moderate, stable pre-prison offending trajectory to a non-offending post-prison trajectory. There is a clear discontinuity in offending from the last pre-prison period to the first post-prison period. The predicted probability of arrest immediately before incarceration is 0.29 and drops to zero in the six months following release. On average, the probability of arrest in the pre-prison period is 0.315 (SD=0.045), and again drops to zero across the four-year post-prison period. The slight increase in arrest probability prior to prison is interrupted, and a stable non-offending pattern emerges upon release. Because post-prison exposure is high following release (over 95% of each post-prison period is spent in the community), reductions in offending are not driven by incapacitation. For these reasons, transition one is labeled as evidence of a positive turning point.

Transition 2 involves membership in Group 1 prior to prison and Group 2 post-prison. The predicted probability of arrest immediately preceding prison is 0.29. Immediately following release, the predicted probability of recidivism is 0.2, marking only a slight decline. Prior to prison the average arrest probability is 0.315 (SD=0.045), while the average post-prison recidivism probability is 0.179 (SD=0.039). The post-prison trajectory is declining, and paired with evidence of a discrete reduction in criminal activity, might suggest a positive turning point. However, *Table 10* demonstrates that individuals in Group 2 post-release have the lowest exposure of any post-prison trajectory group. It is possible that the declining recidivism pattern or the lower probabilities of

arrest exhibited by this group are due in part to incapacitation. For this Transition 2 is not clearly a positive turning point, because reductions in crime may be artificial. To be conservative, transition 2 is not labeled as a turning point.

Transition 3 entails membership in Group 1 prior to prison and Group 3 following release. Discontinuity is indicated by a 0.29 predicted probability of arrest immediately preceding imprisonment, which increases to 0.43 in the six months after release. Prior to prison, the average probability of arrest is 0.315 (SD=0.045). Following release, the average recidivism probability increases to 0.448 (SD=0.021). In each post-prison period, the predicted probability of recidivism is higher than the probability of arrest in any pre-prison period. Even with evidence of incapacitation or reduced exposure in the post-prison period, individuals experiencing this transition offend more in the post-prison period than in the pre-prison period. As such, transition 3 involves moving from a moderate stable pre-prison group to a high activity post-prison group. This pattern indicates escalation or amplification of criminal behavior and is deemed a negative turning point.

Transition 4 involves the transition from Group 2 prior to prison to Group 1 upon release. Prior to prison Group 2 is a relatively low activity group, with an average arrest probability of 0.163 (SD=0.179) in the four years prior to imprisonment. The pre-prison pattern is characterized by non-offending two to four years prior to prison, and a spike in offending in the two years before prison. In the period immediately preceding imprisonment, the predicted probability of arrest is 0.22. The likelihood of criminal behavior drops to zero immediately following release from prison and remains at zero for four years after release. Despite ample time in the community, individuals in Group 1

following release do not recidivate. For individuals experiencing Transition 4, imprisonment interrupts the low level of pre-prison offending, and no post-release offending is observed. This decline is labeled a positive turning point.

Transition 5 marks movement from the second pre-prison group to the second post-prison group. For these individuals, in the six-month interval immediately preceding incarceration, the predicted probability of arrest is 0.22. In the first six months following release, the predicted probability of recidivism declines slightly to 0.20. In the four-year period preceding imprisonment, the average arrest probability is 0.163 (SD=0.179) whereas in the four years following release, the average recidivism probability is 0.179 (SD=0.039). In terms of the progression of criminal behavior before and after prison, the probability of arrest slightly increases prior to prison and decreases upon release. Prior to prison, Group 2 is comprised of individuals who are arrested in 0, 1, or 2 time six month intervals. Upon release, Group 2 recidivates in 1, 2, or 3 time periods, despite less time in the community. These are slight differences that do not clearly suggest discontinuity in offending and, actually, the evidence is conflicting. The average probabilities reflect an increase in criminal behavior following release from prison, while the predicted probability of arrest in the six months before and after prison and the progression of behavior suggest a decline in criminal behavior. Absent consistent evidence of discontinuity in offending (or the direction of change in offending), transition 5 is not considered a turning point

Finally, transition 6 involves membership in Group 2 prior to prison and Group 3 following release. This transition is considered a negative turning point. These individuals were arrested in in 2 or fewer pre-prison periods, all in the two years prior to

prison. After prison these individuals move to is the high activity group, with recidivism occurring in two or more post-prison periods. This suggests an increase in offending. The predicted probability of criminal behavior jumps from 0.22 immediately before prison to 0.43 upon release. The average recidivism probability is also higher upon release, increasing from 0.163 (SD=0.179) in the four years before imprisonment to 0.448 (SD=0.021) upon release. Although there is an increase in the probability of arrest in the two years prior to prison for the second pre-prison group, this spike may be artificial in that it captures the timing of a single arrest in the pre-prison period. Moving to a high recidivism post-prison offending trajectory from a low arrest pre-prison groups suggest offending amplification and therefore is considered a negative turning point.

According to this classification scheme, there is clearly heterogeneity in the transitions between pre- and post-prison trajectory groups. Of the six possible transitions between trajectory groups, two suggested prison serves as a positive turning point, two suggested prison serves as a negative turning point, and two did not demonstrate clear evidence of discontinuity in offending.

Table 11. Turning Point Classifications and Joint Probabilities of Group Membership for First-Time Prisoners

Transition	Turning Point?	Joint Probability of Group Membership
1. Group 1 Pre-Prison to Group 1 Post Prison	Positive Turning Point	0.1925
2. Group 1 Pre-Prison to Group 2 Post-Prison	---	0.3460
3. Group 1 Pre-Prison to Group 3 Post-Prison	Negative Turning Point	0.0179
4. Group 2 Pre-Prison to Group 1 Post-Prison	Positive Turning Point	0.2322
5. Group 2 Pre-Prison to Group 2 Post-Prison	---	0.2062
6. Group 2 Pre-Prison to Group 3 Post-Prison	Negative Turning Point	0.0053

Table 11 summarizes how each transition is classified in the first-time prisoner sample and contains joint probabilities of membership in a specific pre- and post-prison trajectory group. These probabilities reflect the proportion of the first-time prisoner sample experiencing each transition. Based on the classification scheme, 42.5% of first-time prisoners exhibit evidence that imprisonment serves as a of a positive turning point. By contrast, only 2.3% of first-time prisoners exhibit evidence that imprisonment serves as a negative turning point. The small percentage is due in part to the small size of the high recidivism trajectory group, comprising less than 6% of the first-time prisoner sample. Importantly, however, the majority of first time prisoners (55%) demonstrate no clear turning point in their offending patterns before and after prison. In the section to follow, the same analytic procedure is employed in the repeat prisoner sample to assess whether comparable heterogeneity is observed.

4.2.4 Pre-Prison Trajectories for Repeat Prisoners

Of the 24,892 adults released from a PA prison onto parole supervision between 2006-2008, 11,737 had one or more prior stays in a PA prison. These repeat prisoners comprise the analytic sample for the second iteration of the dual trajectory model. The pre- and post-prison trajectory models are described for this sample, and the transitions between trajectory groups are classified as positive and negative turning points. This section concludes with a comparison of turning points in the first-time and repeat-prison samples[25].

Table 12. Probability of Arrest in Each Pre-Prison Trajectory Period for Repeat and First-Time Prisoners

Time Period	Probability of Arrest- Repeat Prisoners	Probability of Arrest- First Time Prisoners
3.5 to 4.0 Years Before Prison	0.1487	0.1816
3.0 to 3.5 Years Before Prison	0.1371	0.1858
2.5 to 3.0 Years Before Prison	0.1298	0.1919
2.0 to 2.5 Years Before Prison	0.1149	0.2926
1.5 to 2.0 Years Before Prison	0.1172	0.2482
1.0 to 1.5 Years Before Prison	0.1413	0.3365
0.5 to 1.0 Years Before Prison	0.2331	0.4820
0.0-to 0.5 Years Before Prison	0.4023	0.2620

Table 12 displays the average probability of arrest in each six-month interval in the four years prior to the focal imprisonment for repeat prisoners and first-time prisoners. In seven of the eight pre-prison periods, repeat prisoners have a lower probability of arrest than first-time prisoners. This pattern shifts in the six months immediately preceding imprisonment, when repeat prisoners have a 40% chance of being

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[25] It should be noted that the trajectory patterns derived from the repeat prisoner are not directly comparable to the first-time prisoner sample, because individuals who desisted after their first prison stay are not included in the repeat prisoner sample. In addition, for repeat prisoners, it is possible that their pre-prison trajectory pattern is actually the post-prison trajectory following another stay occurring in the four years prior to prison. For these reasons, comparing the dual trajectory results for first-time and repeat prisoner is only a descriptive exercise rather than an inferential one.

arrested, while only 26% of first-time prisoners experience arrest. Whereas the likelihood arrest steadily increases before imprisonment for first-time prisoners, in the 2.5 to 4 years prior to the focal imprisonment, the likelihood of arrest for repeat prisoners decreases. It is not until two years prior to the focal imprisonment that the likelihood of arrest increases repeat prisoners.

Table 13. Count of Pre-Prison Trajectory Periods with at least One Arrests— Repeat Prisoners vs. First-Time Prisoners

Number of Pre-Prison Trajectory Periods with an Arrest	Frequency- Repeat Prisoners	Percentage- Repeat Prisoners	Percentage- First Time Prisoners
0	2,503	21.33%	3.31%
1	4.559	38.84%	36.47%
2	2.779	23.68%	28.54%
3	1.245	10.61%	17.93%
4	451	3.84%	8.80%
5	151	1.29%	3.54%
6	37	0.32%	1.10%
7	11	0.09%	0.31%
8	1	0.01%	0.0%

The count of pre-prison trajectory periods in which an arrest was observed for repeat prisoners and first-time prisoners are displayed in *Table 13*. Again, it appears that first time prisoners are arrested more often than repeat prisoners prior to the focal imprisonment. For example, *Table 13* shows that repeat prisoners are almost seven times more likely to experience no arrests in the four years prior to imprisonment (excluding the commitment arrest if applicable). This is likely the case if repeat prisoners are on parole supervision and can be re-incarcerated for technical violations that do not involve an arrest. Thirty-two percent of first-time prisoners are arrested in three or more pre-prison periods, while only 16% of repeat prisoners are arrested this much in the four years preceding the focal imprisonment.

Higher levels of offending among first time prisoners in the pre-prison could also be a function of time on the street in the pre-prison period. Because repeat prisoners may be on parole supervision prior to the focal imprisonment, they may be scrutinized more closely by the criminal justice system or have higher risk of incarceration than individuals not on parole. Incarceration during the prior to prison incapacitates individuals by taking them out of a community setting, such that the probability of arrest drops to zero.

Table 14 contains the average exposure time for repeat prisoners in each pre-prison trajectory period[26]. Comparable statistics are not available for first time prisoners because exposure is measured as proportion of time on the street relative to time spent in state prison. By definition, prior to the first state imprisonment, all first timers have exposure of 1. The values in *Table 14* demonstrate than while repeat prisoners spend the majority of each pre-prison period in the community (all rates exceed 0.5), there are still high levels of incarceration prior to prison. For example, the first row, a value of 0.7050 indicates that in the six months 3.5 to 4 years before the focal imprisonment, the average repeat prisoner was in the community 70% of the time and incarcerated in state prison 30% of the time. Average exposure remains around 0.7 until the 18 months prior to the focal imprisonment when repeat prisoners spend more time in the community. As such, the lower probability of arrest exhibited by repeat prisoner in the pre-prison period could reflect incapacitation.

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[26] Exposure time is calculated identically to the figures presented in *Table 8*. The number of days spent in the community (not in a state prison) during a six-month interval is divided by the total number of days in the six-month interval. The quantity in *Table 14* reflect the proportion of time in each six-month period spent on the street. Quantities closer to 1 reflect more time on the street while quantities closer to zero indicate more time spent in prison.

Table 14. Average Pre-Prison Exposure Time for Repeat Prisoners

Pre-Prison Trajectory Period	Average Exposure Time
3.5 to 4.0 Years Before Prison	0.7050
3.0 to 3.5 Years Before Prison	0.7013
2.5 to 3.0 Years Before Prison	0.6930
2.0 to 2.5 Years Before Prison	0.6926
1.5 to 2.0 Years Before Prison	0.7091
1.0 to 1.5 Years Before Prison	0.7545
0.5 to 1.0 Years Before Prison	0.8393
0.0-to 0.5 Years Before Prison	0.9437

Despite evidence that repeat prisoners are incapacitated for part of the pre-prison period, the trajectory models are estimated without accounting for exposure[27]. Pre-prison trajectory models for repeat prisoner were estimated with cubic groups. The models converged with up to five groups. Model fit statistics for each solution are included in *Table 15*. Classification error seems to increases as more than three groups are added, as indicated by lower average posterior probabilities and odds of correct classification in the four- and five-group solutions. For this reason, only the results of the two- and three-group solutions are discussed.

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[27] Like in the post-prison trajectory models for first time prisoners, including exposure time in the trajectory model itself introduces classification error and convergence issues. *Appendix B* documents the challenges faced by including exposure in the trajectory models. As this works seeks to determine whether prison is a turning point by observing transitions between pre-and post-prison trajectory groups, classification certainty must be a priority. Without reasonable confidence that individuals are correctly classified into pre- and post-prison trajectory groups, transitions between those groups become less meaningful and less can be discerned about imprisonment as a turning point. The decision was made to exclude exposure from all trajectory models moving forward, and instead descriptively consider how time on the street relates to the trajectory patterns observed.

Table 15. Pre-Prison Model Fit Statistics for Repeat Prisoners

	One Group	Two Groups	Three Groups	Four Groups	Five Groups
BIC	-41671.8	-41248.91	-41045.2	-40945.89	-40930.11
AvePP$_j$ (%)					
Group 1	1 (100%)	0.822 (69.24%)	0.780 (62.26%)	0.534 (15.83%)	0.716 (14.07%)
Group 2	---	0.757 (30.75%)	0.727 (13.46%)	0.730 (48.34%)	0.624 (36.59%)
Group 3	---	---	0.688 (24.28%)	0.657 (19.25%)	0.493 (7.56%)
Group 4	---	---	---	0.691 (15.57%)	0.719 (39.46%)
Group 5	---	---	---	---	0.681 (2.31%)
OCC$_j$					
Group 1	---	2.053	2.144	6.087	15.410
Group 2	---	6.995	17.103	2.883	2.881
Group 3	---	---	6.873	8.034	11.905
Group 4	---	---	---	11.237	3.928
Group 5	---	---	---	---	90.495

Figure 5 depicts the two-group solution for repeat prisons. The vast majority of repeat prisoners were classified into a pre-prison trajectory with a low probability of arrest. For Group 1, the probability of arrest remains below 0.1 until the year immediately preceding the focal imprisonment, when the probability of arrest rapidly increases from 0.09 to 0.42. By contrast, roughly 31% of repeat prisoners are divided into a moderate group (Group 2), with a relatively stable probability of arrest of roughly 0.25 in the four years prior to prison. The probability of arrest slightly increases for to 0.35 in the year immediately preceding imprisonment.

Figure 5. Two Group Pre-Prison Trajectory Solution for Repeat Prisoners
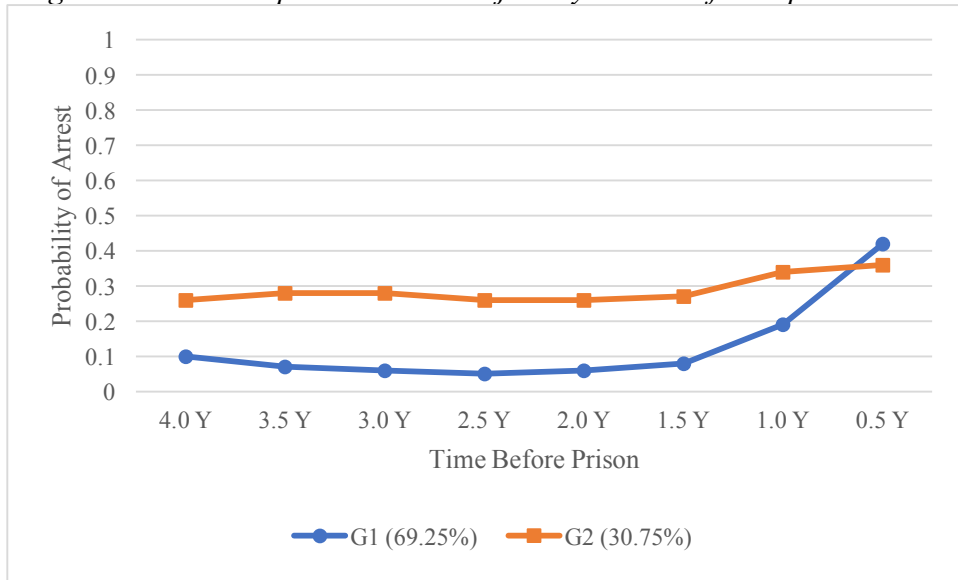
Figure 6 depicts the three-group solution for the repeat prisoner sample. Again, over 60% of repeat prisoners exhibit a very low probability of arrest in the four years preceding incarceration that increases in the year prior to prison (Group 1). Adding a third group splits the relatively constant moderate offending trajectory from the two-group solution into one declining and one increasing trajectory, comprising 13.5% and 24.3% of repeat prisoners, respectively. It appears that the two group solution masks heterogeneity in arrest probabilities of repeat prisoners. Although the average posterior probability for Group 3 is slightly under the recommended threshold of 0.7, the odds of correct classification indicate that individual observations are classified into Groups 2 and 3 with an acceptable certainty. For this reason, the three-group pre-prison solution is selected for repeat prisoners.

Figure 6. Three-Group Pre-Prison Trajectory Solution for Repeat Prisoners

Y-axis: Probability of Recidivism (0 to 1)
X-axis: Time Before Prison (4.0 Y, 3.5 Y, 3.0 Y, 2.5 Y, 2.0 Y, 1.5 Y, 1.0 Y, 0.5 Y)

Legend: G1 (62.26%), G2 (13.46%), G3 (24.28%)
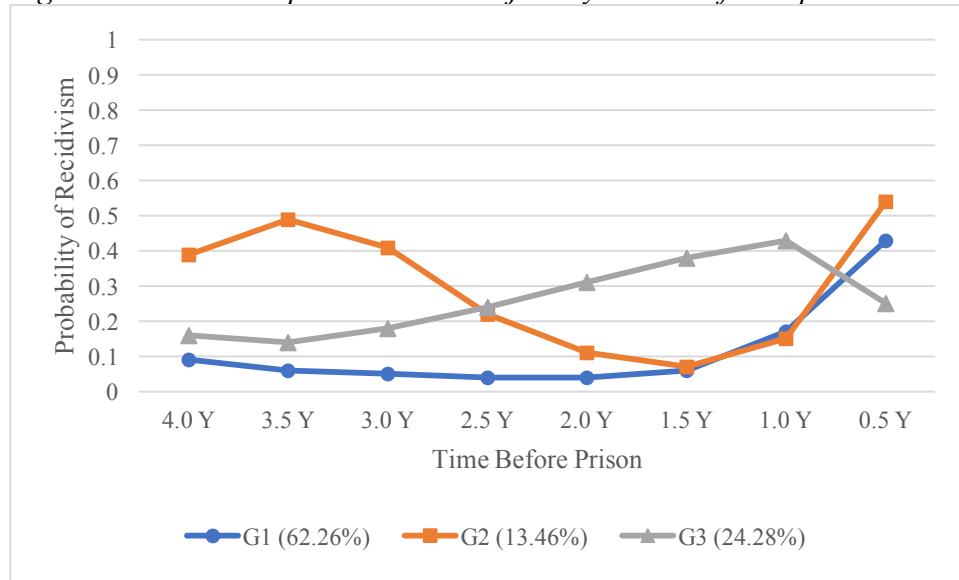
Table 16 contains the proportion of each pre-prison trajectory period in which individuals were not incarcerated (exposure time), disaggregated by trajectory group. The second column of *Table 17* suggests that the low probability of arrest in Group 1 may be driven by incapacitation. On average, individuals in the first trajectory group spend 40% of the two to four years before the focal imprisonment in a state prison. At the same time, this group exhibits a probability of arrest that is below 0.1. As exposure increases in the time leading up to the focal imprisonment, the likelihood of arrest also increases. The same relationship between exposure and the probability of arrest is observed for the second trajectory group. For Group 2, the declining probability of arrest in the 3.5 to 1.0 years prior to the focal imprisonment is mirrored by a decrease in proportion of street time for Group 2 during the same period. This pattern suggests that the decline exhibited by Group 2 may be partly due incapacitation rather than decreasing criminal activity prior to prison. Considering exposure time with the estimated probabilities of arrest suggest that Groups 1 and 2 are comprised of "high risk" offenders, meaning that they are consistently arrested when in the community.

Table 16. Pre-Prison Exposure for Repeat Prisoners, by Trajectory Group

Years Before Focal Imprisonment	Group 1 Average Proportion of Time on Street	Group 2 Average Proportion of Time on Street	Group 3 Average Proportion of Time on Street
3.5 to 4.0 Years	0.6201	0.9667	0.9302
3.0 to 3.5 Years	0.6163	0.9492	0.9324
2.5 to 3.0 Years	0.6145	0.8594	0.9320
2.0 to 2.5 Years	0.6276	0.7108	0.9395
1.5 to 2.0 Years	0.6649	0.5961	0.9282
1.0 to 1.5 Years	0.7381	0.5845	0.8880
0.5 to 1.0 Years	0.8376	0.7139	0.8972
0.0 to 0.5 Years	0.9429	0.9171	0.9578

Unlike Groups 1 and 2, the likelihood of arrest for Group 3 does not directly correspond to changes in exposure time. Though the proportion of time on the street remains high across the pre-prison period, the probability of arrest steadily increases, ranging from 0.16 four years prior to the focal imprisonment to 0.43 in the 6-12 months immediately preceding imprisonment. The low likelihood of arrest in the 2-4 years prior to imprisonment does not appear to be due to lack of time on the street. At this time, individuals in Group 3 are exhibit low risk of arrest while in the community for a greater proportion of time than other groups. This lack of correspondence between exposure and risk of arrest suggest that the third trajectory group is comprised of individuals who remain at lower risk of arrest despite time in the community.

4.2.5. Post-Prison Trajectories for Repeat Prisoners

In the post-prison period, the likelihood of recidivism among repeat prisoners is highest during the first year of release, and steadily declines after 12 months. A pattern of declining recidivism risk is well documented in the literature and also mirrored in the first-time prisoner sample. Though the declining pattern is consistent, *Table 17* illustrates

that the likelihood of observing recidivism is greater for repeat prisoners than first-timers in every post-prison trajectory period.

Table 17. Probability of Recidivism in Each Post-Prison Trajectory Period for Repeat Prisoner and First-Time Prisoners

Trajectory Period	Probability of Recidivism- Repeat Prisoners	Probability of Recidivism- First Timers
0.0 to 0.5 Years After Prison	0.2668	0.1567
0.5 to 1.0 Years After Prison	0.3015	0.1887
1.0 to 1.5 Years After Prison	0.2423	0.1649
1.5 to 2.0 Years After Prison	0.2080	0.1475
2.0 to 2.5 Years After Prison	0.1779	0.1348
2.5 to 3.0 Years After Prison	0.1575	0.1249
3.0 to 3.5 Years After Prison	0.1419	0.1087
3.5 to 4.0 Years After Prison	0.1345	0.1054

Table 18 displays the number of post-prison trajectory periods in which at least one recidivism event is observed. Recidivism is a relatively rare event, in that most repeat prisoners (roughly 75%) recidivate in two or fewer post-prison periods. Comparing columns three and four confirms that repeat prisoners recidivate more than first timers. Seventy-six percent of repeat prisoners recidivate in at least one post-prison period, compared to 57% of first-time prisoners. Paired with evidence that repeat prisoners offend less in four-year period prior to the focal imprisonment, the higher level of recidivism upon release exhibited in *Tables 17* and *18* serve as preliminary evidence that prison is more likely to serve as a negative turning point for repeat prisoners than first time prisoners.

Table 18. Count of Post-Prison Trajectory Periods in which at least One Recidivism Event Occurred-- Repeat Prisoners vs. First-Time Prisoners

Number of Post-Prison Periods with Recidivism Event	Frequency- Repeat Prisoners	Percentage-Repeat Prisoners	Percentage- First Time Prisoners
0	2,845	24.24%	42.55%
1	3,259	27.77%	24.33%
2	2,876	24.50%	19.13%
3	1,583	13.49%	8.86%
4	787	6.71%	3.41%
5	298	2.54%	1.27%
6	68	0.58%	0.37%
7	16	0.14%	0.08%
8	5	0.04%	0.02%

Table 19 contains the average exposure time for repeat prisoners in each post-prison period. Across the four-year follow-up period, the average amount of time on the street decreases, but never surpasses 0.74. Despite decreasing time on the street, on average least three quarters of each post-prison period is spent in the community. Comparing columns two and three of *Table 19* demonstrates that on average, first-time prisoners spend a larger portion of each post-prison period in the community than repeat prisoners.

Table 19. Average Post-Prison Exposure Time for Repeat and First-Time Prisoners

Years after Release from Prison	Average Proportion of Time on Street- Repeat Prisoners	Average Proportion of Time on the Street- First Time Prisoners
0.0 to 0.5 Years	0.9225	0.9561
0.5 to 1.0 Years	0.8079	0.8790
1.0 to 1.5 Years	0.7549	0.8339
1.5 to 2.0 Years	0.7480	0.8244
2.0 to 2.5 Years	0.7576	0.8318
2.5 to 3.0 Years	0.7680	0.8369
3.0 to 3.5 Years	0.7824	0.8474
3.5 to 4.0 Years	0.7950	0.8536

Post-prison criminal trajectories for repeat offenders were estimated with quadratic and one intercept trajectory groups. The models converged up with up to seven groups. Regardless of the number of groups, all recidivism trajectories exhibited declining patterns across the four-year follow-up period (although rates of decline differed). Adding more than five groups resulted in the emergence of several very small groups, many of which demonstrated only slight variations of existing groups. These additional groups also exhibited a high degree of classification error, and did not add substantive value to the overall model or description of recidivism in the repeat prisoner sample. As such, model fit statistics are presented for solutions with five or fewer groups.

Table 20. Post-Prison Model Fit Statistics for Repeat Prisoners

	One Group	Two Groups	Three Groups	Four Groups	Five Groups
BIC	-46610.14	-46080.54	-45864.10	-45849.03	-40930.11
AvePP$_j$ (%)					
Group 1	1 (100%)	0.747 (31.93%)	0.662 (32.92%)	0.439 (11.09%)	0.404 (9.76%)
Group 2	---	0.849 (68.07%)	0.587 (22.26%)	0.563 (24.98%)	0.563 (25.43%)
Group 3	---	---	0.817 (44.84%)	0.733 (46.43%)	0.686 (23.10%)
Group 4	---	---	---	0.667 (17.50%)	0.713 (41.61%)
Group 5	---	---	---	---	0.841 (0.09%)
OCC$_j$					
Group 1	---	6.302	3.983	6.283	6.273
Group 2	---	2.627	4.976	3.875	3.785
Group 3	---	---	5.480	3.164	7.258
Group 4	---	---	---	9.429	3.478
Group 5	---	---	---	---	5785.127

Regardless of the number of groups, the fit statistics presented in *Table 20* fall below the recommended thresholds for model selection, suggesting that all models are poorly fit. In both the four and five group models, the average posterior probability for a

one group falls below 50%, indicating more than 50% error in group assignment. Less than 50% classification accuracy is not acceptable. For this reason, I focus on the two- and three-group solutions exclusively.

Figure 7 displays the three-group post-prison trajectory solution for repeat prisoners. I depict only the three-group solution because the two-group model contains identical trajectory patterns. Both the two- and three-group models contain one group with a low, stable probability of recidivism in the four years following prison. In both the two- and three-group solutions this group comprises an estimated 32% of repeat prisoners. The two and three group specification also contain a high probability trajectory, where the probability of arrest decreases slightly from 0.4 to 0.23 in the four years following release. In the two-group solution, this declining group comprises almost 70% of the sample.

Figure 7. Post-Prison Trajectories for Repeat Prisoners
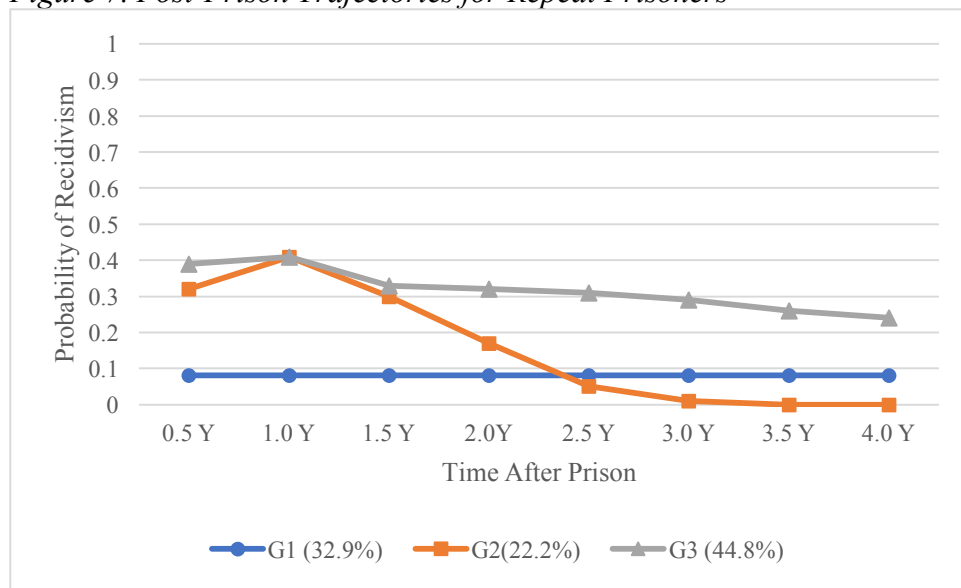
When a third group is added this high probability group splits into two groups: one with an identical trajectory pattern (44.5%) and another that exhibits a rapid declining probability of recidivism (22.6%) The rapidly declining trajectory group begins

with a 0.4 probability recidivism immediately following release that declines to zero after three years.

In light of the generally poor fit inherent to all post-prison models, additional criteria must be considered to select the appropriate number of groups. In both the- two and three-group solution, Group 1 contains all individuals with zero recidivism events. The probability of arrest is greater than 0 because this group also contains some individuals with recidivism occurring in only one post-prison period, raising the group average probability. In the two-group model, all other observations are in the high probability trajectory group. In the three-group model, Group 2, or the rapidly declining group, contains individuals with only one or two arrests in the post-prison period. The declining trajectory suggests that these individuals recidivate quickly and not again in the four-year observation window (potentially because they are re-incarcerated). Group 3, the high probability group, contains all individuals with recidivism events occurring in four or post-prison trajectory periods. Despite low OCC and AvePP values, considering how individuals are classified according to their recidivism counts suggests that the three-group model is sufficiently well-fit and captures difference in recidivism within the sample. For this reason, I select the three-group solution. To account for classification error when predicting turning points in subsequent analyses, multinomial logistic regressions were estimated with posterior probabilities of group membership (PPGM) as weights. This allows individuals with classified with less certainty contribute less to the post-estimation models, reducing bias from classification error.

Table 21. Post-Prison Exposure for Repeat Prisoners, by Trajectory Group

Years after Release from Prison	Group 1 Average Proportion of Time on Street	Group 2 Average Proportion of Time on Street	Group 3 Average Proportion of Time on Street
0.0 to 0.5 Years	0.9987	0.8717	0.8846
0.5 to 1.0 Years	0.9993	0.6488	0.7325
1.0 to 1.5 Years	0.9995	0.4812	0.7031
1.5 to 2.0 Years	0.9687	0.4575	0.7286
2.0 to 2.5 Years	0.9319	0.5247	0.7444
2.5 to 3.0 Years	0.9149	0.5974	0.7406
3.0 to 3.5 Years	0.9191	0.6438	0.7443
3.5 to 4.0 Years	0.9276	0.6695	0.7524

Table 21 contains the group-specific average proportion of time on the street in each post-prison time-period. For Group 1, the average proportion of street time exceeds 0.9 in each post-prison period, suggesting that low probability of recidivism is not a result of incapacitation. The rapid decline observed for the Group 2, however does seem to be partly due to reductions in time spent in the community. In the second year after release, individual in group two on average spend less than 50% of the year on the street. In the third and fourth year following release, when the probability of arrest declines to zero, exposure time increases but remains low relative to the rest of the sample. As such, the entire decline in recidivism probability observed for Group 2 cannot be attributed to incapacitation, although exposure time is certainly part of the story. Group 3 remains in the community for 75% of the four years following imprisonment. There are not marked changes in time on the street for this group.

4.2.6 Transitions from Pre- to Post-Prison Criminal Trajectories for Repeat Prisoners

Using the three-group pre- and post-prison trajectory solutions for repeat prisoners, the dual trajectory approach produces nine possible transitions between

trajectory groups. Each transition and conditional probabilities of group membership are

illustrated in *Figure 8.*

Figure 8. Probabilities of Transitioning from the Three Pre-Prison Groups to all Three Post-Prison Trajectories for Repeat Prisoners

Group 1 (62.26%)

Pr(G1post|G1pre) = 0.387
Pr(G2post|G1pre) = 0.245
Pr(G3post|G1pre) = 0.368

Group 2 (13.46%)

Pr(G1post|G2pre)=0.233
Pr(G2post|G2pre)=0.253
Pr(G3post|G2pre)=0.514

Group 3 (24.28%)

Pr(G1post|G3pre)=0.305
Pr(G2post|G3pre)=0.255
Pr(G3post|G3pre)=0.440
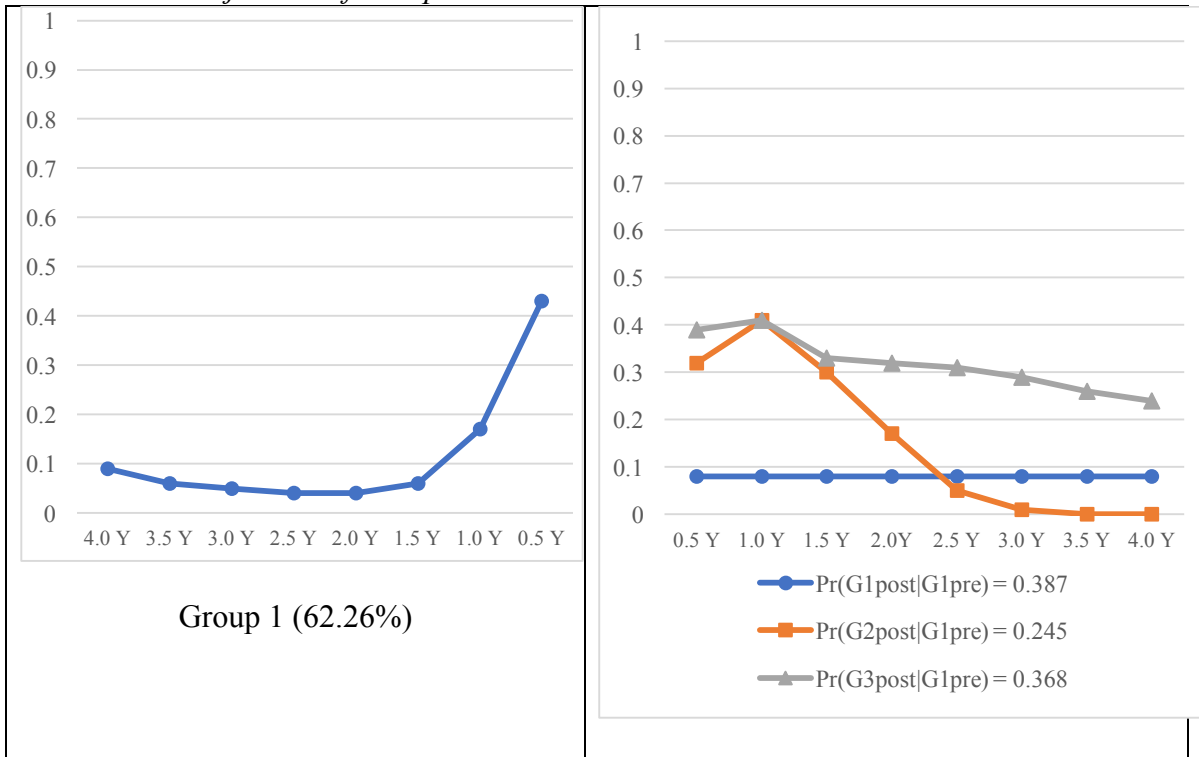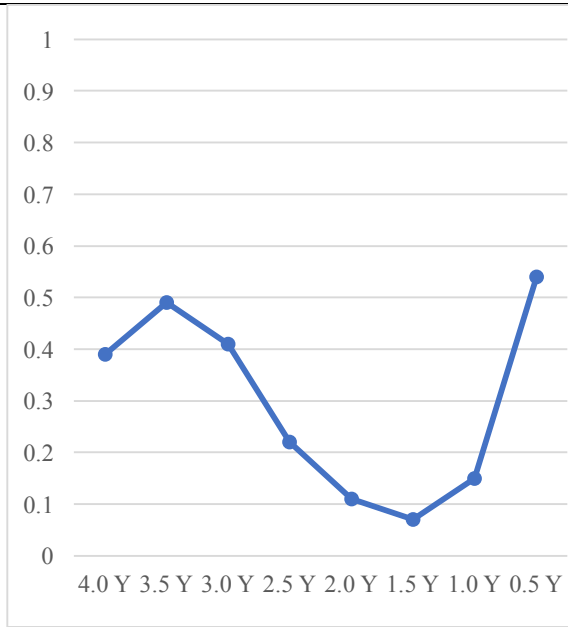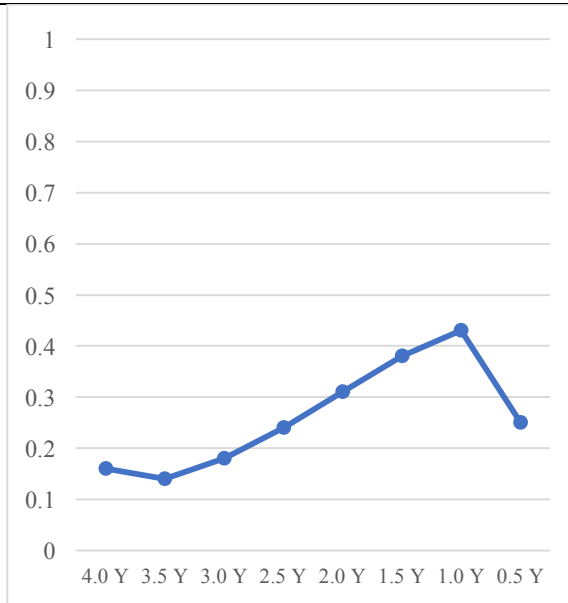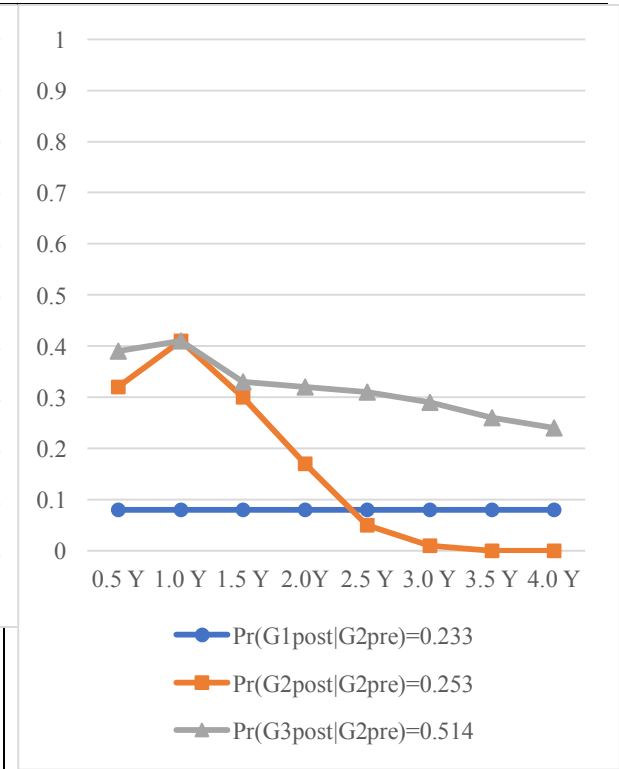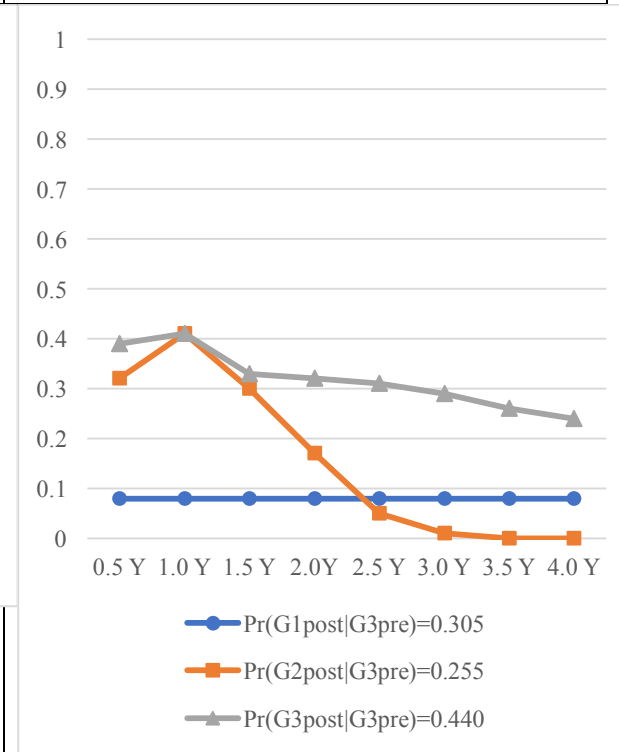
The first row of *Figure 8* depicts the transitions from the first pre-prison trajectory group to each of the post-prison trajectory groups. Recall that in the pre-prison trajectory model Group 1 is composed of individuals with arrests in zero or one pre-prison periods. For individuals in this pre-prison trajectory group, the most likely transition involves to the first post-prison group, characterized by a stable, very low probability of recidivism – it is essentially a non-offending post-prison group. The conditional probability of group membership in the Group 1 following release from prison given assignment to Group 1 before prison is 0.387. The likelihood of an individual transitioning from Group 1 to Group 3 (the high probability recidivism group) in the post-prison is only slightly lower (0.368). One-quarter of individuals in Group 1 prior to prison are classified in the rapidly declining post-prison trajectory (Group 2).

The second pre-prison group is characterized by declining probability of arrest two to four years before prison and an increasing probability of arrest thereafter. The majority of individuals in this group (51%) to the high probability recidivism group. Individuals in Group 2 prior to prison have less than 25% chance of transitioning to the low stable post-prison trajectory, which is substantially lower than the first pre-prison group. Individuals the third pre-prison group are also most likely to transition to the high probability recidivism trajectory post-release (Group 3), however they have a higher likelihood of transitioning to the low stable offending trajectory than individuals in Group 2 prior to prison (31% and 23%, respectively).

Table 22. Turning Point Classifications and Joint Probabilities of Group Membership for Repeat Prisoners

Transition	Turning Point?	Joint Probability of Group Membership
1. Group 1 Pre-Prison to Group 1 Post Prison	Positive Turning Point	0.2848
2. Group 1 Pre-Prison to Group 2 Post-Prison	---	0.1799
3. Group 1 Pre-Prison to Group 3 Post-Prison	Negative Turning Point	0.2703
4. Group 2 Pre-Prison to Group 1 Post-Prison	Positive Turning Point	0.0179
5. Group 2 Pre-Prison to Group 2 Post-Prison	---	0.0194
6. Group 2 Pre-Prison to Group 3 Post-Prison	Positive Turning Point	0.0395
7. Group 3 Pre-Prison to Group 1 Post-Prison	Positive Turning Point	0.0573
8. Group 3 Pre-Prison to Group 2 Post-Prison	---	0.0479
9. Group 3 Pre-Prison to Group 3 Post-Prison	Negative Turning Point	0.0828

Each of the nine transitions are numbered and classified as positive, negative, or non-turning points in *Table 22*. Of the nine possible transitions, four were classified as reflecting a positive turning point and two indicated a negative turning point. The last column of *Table 22* contains the joint probability of membership, which represent the proportion of the repeat prisoner sample that experienced a particular transition.

Transition 1 is characterized by movement from the low, increasing trajectory group prior to prison to a low, stable recidivism group. On average the probability of arrest in the pre-prison period is 0.118 (SD=0.125), compared to a 0.08 average probability of recidivism in the four years following release (SD=0). The probability of arrest immediately preceding the focal imprisonment is 0.43, drops to 0.08 upon release. These values suggest a discontinuity in offending before and after prison. The increasing

pattern in the probability of arrest prior to prison (which may even be understated by time spent incarcerated) was interrupted and the probability of arrest remains low and stable upon release, despite ample time on the street. Transition 1 is therefore classified as a positive turning point.

Transition 2 is slightly harder to interpret. In the six months immediately surrounding the focal imprisonment, the predicted probability of arrest drops from 0.43 to 0.32. However, on average the post-prison recidivism probability is 0.158 (SD=0.156) is higher than the pre-prison average of 0.118 (SD=0.125) in the pre-prison period. The post-prison period is also characterized by a rapid decline in recidivism risk. Although declining risk of recidivism would suggest desistance, *Table 21* demonstrates that part of the declining observed in Group 2 is a function of incapacitation. As such, there is not enough clear evidence that transition 2 is either a positive or a negative turning point.

Transition 3 involves escalation in offending and is considered a negative turning point. On average, the likelihood of recidivism in the four years following release is 0.318 (SD=0.055). This is substantially higher than in the pre-prison period average of 0.118 (SD=0.125). Although there is not a clear jump in the predicted probability of arrest and recidivism immediately following release from prison and the probability of recidivism generally declines across the post-prison period, the probability of recidivism remains high across the follow up period, rather than declining to its pre-prison rate. Individuals in Group 3 in the post-prison period recidivate in 3 or more post-prison period, suggesting consistency in offending that was not observed prior to prison (wherein individuals were arrested in two or fewer pre-prison periods).

The fourth transition involves membership in a high arrest pre-prison group (Group 2) and a low-recidivism group (Group 1). Individuals in Group 2 prior to prison exhibit high likelihood of arrest when in the community, and declines in arrest associate with incarceration. Despite high probability of arrest when in the community prior to the focal imprisonment, individuals experiencing transition 4 offend at very low rates in the post-prison period despite large portions of time not incarcerated. This shift in pattern is suggestive of a positive turning point. The classification as a positive turning point is corroborated by a lower average recidivism probability than pre-prison arrest probability (0.08 (SD=0) and 0.298 (SD=0.170) respectively). There is also evidence of a discrete reduction in the probability of arrest and recidivism before and after prison. The predicted probability of arrest in the six-months preceding incarceration is 0.54 and drops to 0.08 upon release.

Transition 5 involves membership in Group 2 prior to prison and Group 2 upon release. This transition is not classified as a turning point. Although the predicted probability of criminal behavior declines from 0.54 in the six-months prior to the focal imprisonment to 0.32 in the six months after release, and the average probability of recidivism is lower than the average pre-prison arrest probability. Changes in exposure time reveals that low probability of recidivism in the post-prison period is likely a result of incapacitation. In both the pre- and post-prison periods, the probability of arrest or recidivism directly corresponds with exposure time. There is not clear evidence that this pattern was broken after prison. As such declines in offending may be due to incapacitation rather than a change in behavior. For this reason, transition five cannot be credibly classified as a turning point.

Transition 6 involves moving from the second pre-prison trajectory group to the third post-prison trajectory group. On average, the probability of arrest in the pre-prison period is comparable to the average probability of recidivism (0.298 (SD=0.170) and 0.319 (SD=0.055) respectively). There is evidence of a discrete drop in criminal behavior before and after prison. In the six months prior to the focal imprisonment the predicted probability of arrest is 0.54, and declines to 0.32 in the six months following release. The probability of arrest continues to decline across the four-year post-prison period. This decline is not completely attributable to changes in exposure, as exposure time remains stable and high for this group. There appears to be a reduction in criminal behavior after prison in transition 6, indicating a positive turning point.

Transition 7 is characterized as a positive turning point. Prior to prison, the average probability of arrest is 0.261 (SD=0.098). This average decline to 0.08 in the post-prison period. Additionally, the likelihood of arrest in six months prior to the focal imprisonment is 0.25 but drops to 0.08 immediately following release. Because the post-prison recidivism risk remains low despite high exposure (more than 90% of all post-prison periods are spent in the community), this transition is suggestive of an actual change in behavior rather than an artificial decrease.

Transition 8 involves membership in the Group 3 prior to prison and Group 2 upon release. On average, the probability of arrest prior to prison is 0.261 (SD=0.098). This average decreases to 0.158 (SD=0.156) in the post-prison period. Comparing the predicted probability of arrest in the last pre-prison period (0.54) and the first post-prison period (0.32) serves as tentative evidence of discontinuity in offending before and after prison. However, many individuals experiencing this transition offend at high rates

immediately following release from prison and are subsequently incarcerated. The decline in the probability of recidivism observed in Figure 7 (which accounts for the lower average recidivism probability), does not reliably suggest a change in offending behavior because it may be a function of time on the street. Because exposure is low in the post-prison period, there is not enough evidence to determine that a true change in offending occurred.

Finally, transition 9 is characterized as a negative turning point. The average probability of arrest/recidivism increases from 0.261 (SD=0.098) in the pre-prison period to 0.319 (SD=0.055) in the post-prison period. The predicted probability of arrest also jumps from 0.25 in the six months preceding incarceration to 0.39 immediately following release. Despite the slight decline in the recidivism probability across the four-year post-prison period, all eight predicted probabilities of recidivism are higher than the predicted probability of arrest in the last pre-prison period, suggesting escalation occurred.

Given these classifications, for 40% of repeat prisoners, prison appears to serve as a positive turning point. Thirty-five percent of repeat prisoners exhibit evidence of a negative turning point. Unlike with first time prisoners, the majority of which demonstrated no discontinuity, a minority of repeat prisoners (approximately 25%) fail to demonstrate discontinuity in their offending before and after prison.

4.2.7. Summary: Comparing First-Time and Repeat Prisoners

The dual trajectory analyses presented above suggest that prison serves as a turning point for 45.8% of first-time prisoners and 75% of repeat prisoners. While only 2.31% of first-time prisoners are classified as exhibiting a negative turning point, 35.52% of repeat prisoners demonstrate evidence of escalation indicative of a negative turning

point. This pattern is consistent with hypothesis 2A, which states that repeated exposure to imprisonment increases the likelihood of observing a negative turning point. Hypothesis 2B states that prison is more likely to serve as a turning point for first time prisoners. Though compared to repeat prisoners a slightly larger portion of first-time prisoners exhibit evidence of a positive turning point (39.96% vs. 42.5%), for the majority of first-time prisoners, prison did not appear to serve as a turning point. As such, hypothesis 2B is not supported.

4.3. Another Look at Cumulative Disadvantage and Repeated Exposure

In addition to comparing the proportion of first-time and repeat prisons who demonstrate evidence of positive and negative turning points, the importance of repeated exposure to imprisonment may be assessed by determining how the number of prior prison terms changes the odds of observing each type of turning point. To do the dual trajectory procedure was implemented in the full sample, and the transitions between trajectory groups were classified as positive, negative, or non-turning points. A categorical measure of positive, negative, and non-turning points was then regressed on the number of prior imprisonments in a multinomial logistic regression. The value of this additional method is that it does not require a binary distinction between first-time and repeat prisoners. Instead, an individual's entire incarceration history may be considered and potential differential impact of additional prison terms can be discerned.

4.3.1. Pre-Prison Criminal Trajectories for the Full Sample

Table 23. Probability of Arrest in Each Pre-Prison Trajectory Period for Full Sample

Pre-Prison Trajectory Period	Probability of Arrest
3.5 to 4.0 Years Before Prison	0.1661
3.0 to 3.5 Years Before Prison	0.1628
2.5 to 3.0 Years Before Prison	0.1625
2.0 to 2.5 Years Before Prison	0.1613
1.5 to 2.0 Years Before Prison	0.1864
1.0 to 1.5 Years Before Prison	0.2444
0.5 to 1.0 Years Before Prison	0.3647
0.0-to 0.5 Years Before Prison	0.3282

The full sample of parolees contains 24,892 individuals who entered a PA prison between at or after age 22, and were released between 2006 and 2008. *Table 23* contains the probability of arrest in each pre-prison period for the full parolee sample, excluding the arrest which lead to imprisonment (commitment arrest). Across the observation period the probability of arrest is moderate, ranging from 0.16 to 0.36. As the time to the focal imprisonment deceases, arrest becomes more likely. *Table 24* demonstrates that part of this increasing pattern may be due to differential time on the street (exposure time) in the pre-prison period. Between two and four years prior to imprisonment, the sample spends roughly 85% of each six-month interval in the community. This means than on average, 15% of each period is spent incarcerated in the two to four years prior to the focal imprisonment. Less time on the street may account for the lower probability of arrest observed at the same time.

Table 24. Average Exposure Time for Each Pre-Prison Trajectory Period in the Full Sample

Trajectory Period	Average Proportion of Time on the Street
3.5 to 4.0 Years Before Prison	0.8592
3.0 to 3.5 Years Before Prison	0.8575
2.5 to 3.0 Years Before Prison	0.8536
2.0 to 2.5 Years Before Prison	0.8535
1.5 to 2.0 Years Before Prison	0.8616
1.0 to 1.5 Years Before Prison	0.8832
0.5 to 1.0 Years Before Prison	0.9235
0.0-to 0.5 Years Before Prison	0.9731

Table 25. Count of Pre-Prison Trajectory Periods with at least One Arrest—Full Sample

Number of Trajectory Periods with at least One Arrest	Frequency	Percentage	Cumulative Percentage
0	2,938	11.80%	11.80%
1	9,356	37.59%	49.39%
2	6,533	26.25%	75.63%
3	3,604	14.48%	90.11%
4	1,609	6.46%	96.58%
5	617	2.48%	99.06%
6	182	0.73%	99.79%
7	52	0.21%	99.99%
8	1	0.001%	100.00%

Table 25 contains the number of pre-prison periods in which at least one arrest occurred. Consistent with observations from the first-time and repeat prisoner samples, arrest is an infrequent occurrence in the pre-prison period. Excluding the commitment offense, 12% of the full sample was not arrested in the pre-prison period, and another 40% of the sample was arrested in only one pre-prison period. Over 90% of the sample was arrested in three or fewer trajectory periods prior to the focal imprisonment. These arrests are concentrated in the 1.5 years prior to the focal imprisonment (as indicated by the increased probability of arrest during this time in *Table 23*). It is possible that limited

pre-prison criminal activity is a function of incapacitation (e.g. *Table 22*) or criminal justice scrutiny, but average time on the street remained relative high across the trajectory period. No more than 15% of each pre-prison period was spent in prison. However, if individuals are on probation or parole during the observation period, criminal behavior could be lower than in periods of non-supervision (deterrence) or incarceration in a local jail.

The low level of variability in pre-prison arrests for the full sample means that trajectory solutions with fewer groups were preferred. As in the first-time and repeat prisoner samples, the pre-prison trajectory models converged up to four pre-prison groups. *Table 26* contains the model fit statistics for each solution. Across the board, model fit was relatively poor in the full sample. In every solution either the AvePP or OCC for at least one group falls below the recommended standard of 0.7 or 5.0 respectively. As in the repeat prisoner recidivism models, additional criteria must be consulted in model selection.

Table 26. Pre-Prison Model Fit Statistics for Full Sample

	One Group	Two Groups	Three Groups	Four Groups
BIC	-102508.97	-101378.83	-100927.34	-100906.4
$AvePP_j$ (%)				
Group 1	1 (100%)	0.778 (32.03%)	0.6434 (23.65%)	0.745 (41.13%)
Group 2	---	0.827 (67.97%)	0.6994 (12.37%)	0.760 (44.41%)
Group 3	---	---	0.9118 (63.98%)	0.624 (12.57%)
Group 4	---	---	---	0.634 (1.90%)
OCC_j				
Group 1	---	7.425	5.824	4.185
Group 2	---	2.248	16.482	3.960
Group 3	---	---	5.823	11.569
Group 4	---	---	---	89.587

Because the sample size is large (N=24,892), the BIC increases as additional groups are added, regardless of evidence of classification error. For instance, the four-group model contains one group comprising less than 2% of the population, and two of the AvePP and OCC values fall below the recommended standards. Still the BIC increases when the fourth group is added, because the penalty associated with calculating additional parameters for a new group is not great enough to offset the change in log-likelihood. Although the BIC indicates model improvement with a fourth group, because of the low AvePP and OCC values on multiple groups and presence of a very small group, the four-group model is deemed inferior and is excluded from consideration.

Figure 9. Two Group Pre-Prison Trajectory Model- Full Sample
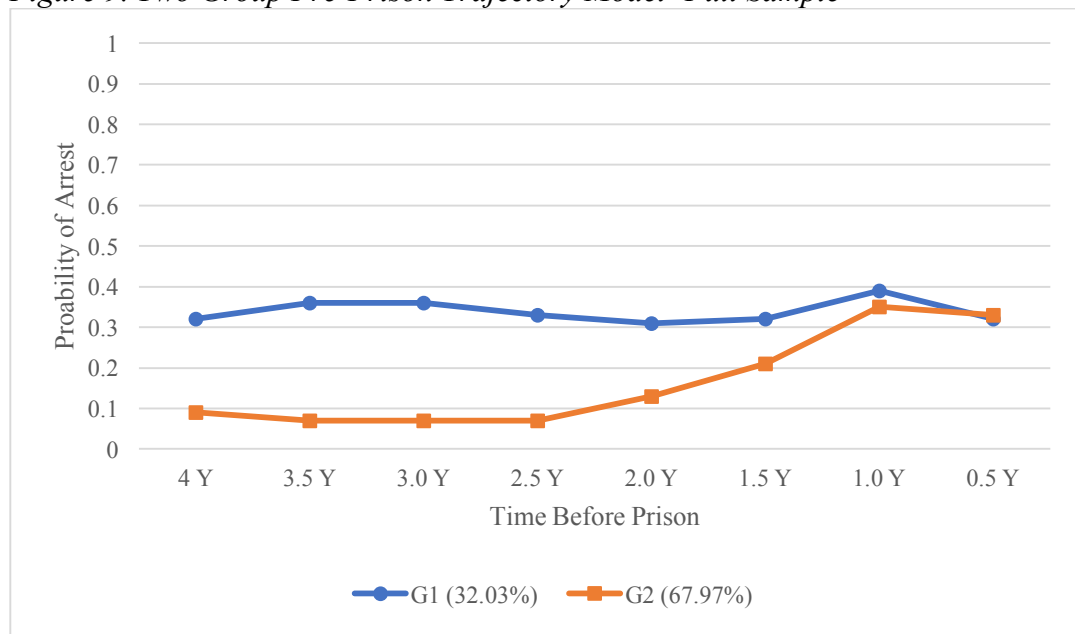
Figure 10. Three Group Pre-Prison Trajectory Model- Full Sample
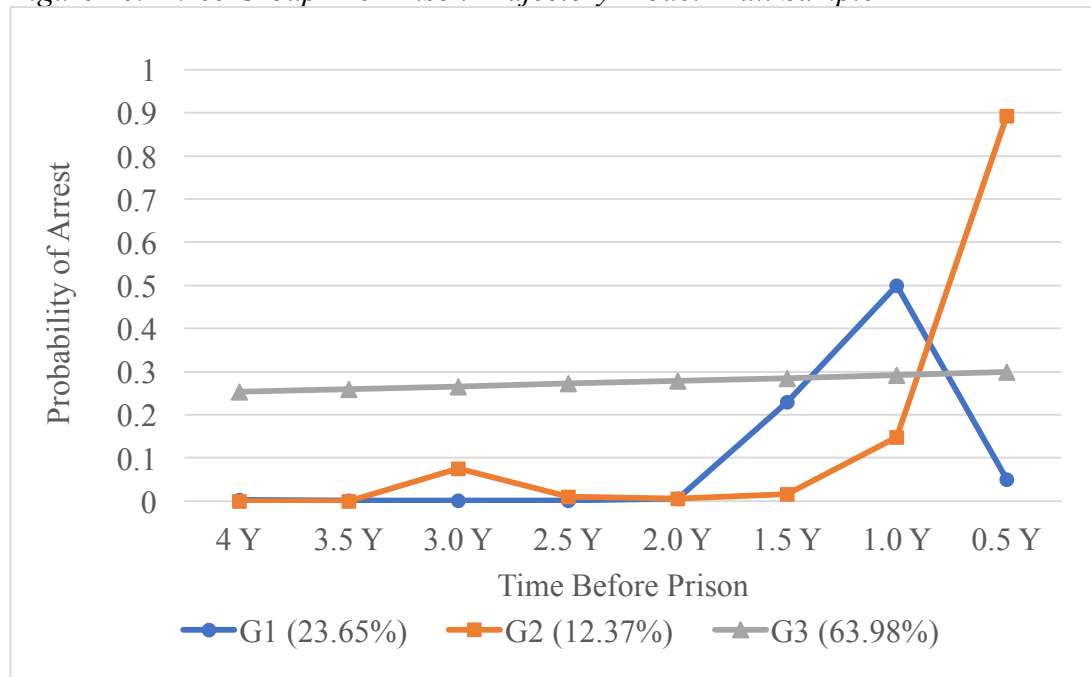
    Figures 9 and 10 contain graphic depictions of the two and three group models of pre-prison trajectories in the full sample. Both solutions contain a group with a low probability of arrest in the 2-4 years prior to the focal imprisonment, which increases closer to the focal imprisonment. In both solutions, this group contains individuals with no arrests prior the focal imprisonment (excluding the commitment arrest (11.8% of the sample)), as well as a portion of individuals with a single arrest in the pre-prison period. The two and three group models also contain a group with a stable, moderate arrest probability across the four-year period. Comparing these two solutions demonstrates that what distinguishes the two- and three-group pre-prison solutions is the presence of a group that is not arrested until the year before the focal imprisonment. The third group comprises roughly 12% of the sample. Individuals in this group have one or two pre-prison arrests, excluding the commitment offense. These arrests occur in the 12 months prior to imprisonment, suggesting that there is a spike in arrest risk right before

imprisonment. In the two group model these individuals are classified into the low, increasing risk group, even though the probability of arrest in the period immediately preceding the focal imprisonment is higher for these individuals. The addition of the third group more accurately captures the timing of the pre-prison arrests. In the three-group solution, individuals in both the first and second group are arrested in only one or two pre-prison periods, either in the six months immediately preceding the focal imprisonment, or in the 6-12 months before prison. Adding a third groups captures the portion of the sample that has a high likelihood of arrest immediately before imprisonment, and distinguishes it from the lower risk group, which is arrested only in 6-12 months prior to imprisonment. For this reason, the three-group solution is selected.

Table 27. Pre-Prison Exposure for Full Sample, by Trajectory Group

Years Before Focal Imprisonment	Group 1 Average Proportion of Time on Street	Group 2 Average Proportion of Time on Street	Group 3 Average Proportion of Time on Street
3.5 to 4.0 Years	0.7775	0.6554	0.9575
3.0 to 3.5 Years	0.7780	0.6519	0.9536
2.5 to 3.0 Years	0.7954	0.6462	0.9396
2.0 to 2.5 Years	0.8201	0.6697	0.9195
1.5 to 2.0 Years	0.8490	0.7296	0.9025
1.0 to 1.5 Years	0.8828	0.8078	0.9028
0.5 to 1.0 Years	0.9173	0.8998	0.9331
0.0 to 0.5 Years	0.9649	0.9745	0.9773

Considering pre-prison exposure (*Table 27*) demonstrates the value of the three-group model. Part of what drives the low probability of arrest in the pre-prison period is incapacitation, but the second pre-prison group is incapacitated at a higher rate than the first group. In the four years prior to the focal imprisonment both groups 1 and 2 spend a modest portion of each pre-prison period incarcerated in state prison. For Group 1 this proportion ranges from 12% to 23% until the years immediately preceding the focal

imprisonment, and for Group 2 this proportion ranges from 20%-34%. For Group 1, the arrest probability remains low even when exposure time increases. Group 2, on the other hand demonstrates that as exposure increases, the arrest probability also spikes, suggesting that when in the community, the likelihood of arrest is higher for these individuals. It appears that Group 2 exhibits a low probability of arrest because of incapacitation whereas the low likelihood of arrest for Group 1 is more likely reflective of non-offending. It is clear that Groups 1 and 2 are distinct, lending support to the selection of the three-group solution.

4.3.2 Post-Prison Criminal Trajectories for Full Sample

Table 28. Probability of Recidivism in Each Post- Prison Trajectory Period for the Full Sample

Trajectory Period	Probability of Recidivism
0.0 to 0.5 Years After Prison	0.2086
0.5 to 1.0 Years After Prison	0.2419
1.0 to 1.5 Years After Prison	0.2014
1.5 to 2.0 Years After Prison	0.1760
2.0 to 2.5 Years After Prison	0.1551
2.5 to 3.0 Years After Prison	0.1402
3.0 to 3.5 Years After Prison	0.1243
3.5 to 4.0 Years After Prison	0.1191

Table 28 contain the probability of recidivism in the four years following release from prison. Consistent with official recidivism statistics (e.g. Kaeble & Bonczar, 2015), the probability of arrest is highest in the year immediately following release. Here, the probability of recidivism spikes in the 6-12 months following release from prison then declines thereafter. This pattern of declining risk after prison could be a function of compositional changes in the sample, if high risk individual recidivate quickly and are re-incarcerated quickly. This possibility is preliminarily supported by *Table 30*, which contains the average proportion of each post-release interval in which an individual

remains in the community. *Table 29* demonstrates that as time since release increases, larger portions of each post-prison trajectory period were spent re-incarcerated in a PA prison.

Table 29. Average Exposure Time in Each Post-Prison Trajectory Period in the Full Sample

Years after Release from Prison	Average Proportion of Time on Street
0.0 to 0.5 Years	0.94026
0.5 to 1.0 Years	0.8454
1.0 to 1.5 Years	0.7966
1.5 to 2.0 Years	0.7884
2.0 to 2.5 Years	0.7968
2.5 to 3.0 Years	0.8044
3.0 to 3.5 Years	0.8168
3.5 to 4.0 Years	0.8260

Table 30 contains the number of post-prison periods in which at least one recidivism event occurred. In the four years following release from the focal imprisonment, 66% of the full sample was arrested or re-incarcerated at least once. The vast majority of the sample is arrested or re-incarcerated in three or fewer post prison trajectory periods (almost 95%). Just under sixty percent of the sample only recidivates in a single post-prison trajectory period.

Table 30. Count Post-Prison Trajectory Periods with at least One Recidivism Event— Full Sample

Number of Post-Prison Periods with Recidivism Event	Frequency	Percentage	Cumulative Percentage
0	8,442	33.91%	33.91%
1	6,460	25.95%	58.87%
2	5,392	21.66%	81.53%
3	2,748	11.04%	92.57%
4	1,235	4.96%	97.53%
5	465	1.87%	99.40%
6	117	0.47%	99.87%
7	26	0.10%	99.97%
8	7	0.03%	100%

Even with the low level of variability in recidivism, when estimated with quadratic groups and one intercept group, the post-prison trajectory models converged with as many as eight groups in the full sample. Despite convergence, models containing more than five trajectory groups were clearly inferior to models with fewer groups. Evidence of poor fit was found in the presence of very small groups (comprising less than 1% of the sample), AvePP values lower than 0.5, and failure to classify any observations into certain trajectory groups[28]. For this reason, *Table 31* contains the fit statistics for solutions containing between five or fewer trajectory groups.

Table 31. Post-Prison Trajectory Model Fit Statistics for the Full Sample

	One Group	Two Groups	Three Groups	Four Groups	Five Groups
BIC	-88040.48	-88035.26	-87893.27	-87616.43	-87569.39
AvePP$_j$ (%)					
Group 1	1 (100%)	0.811 (41.00%)	0.588 (19.91%)	0.581 (19.65%)	0.584 (19.75%)
Group 2	---	0.838 (59.0%)	0.883 (68.57%)	0.570 (19.78%)	0.477 (10.78%)
Group 3	---	---	0.687 (11.52%)	0.730 (44.12%)	0.667 (38.05%)
Group 4	---	---	---	0.696 (16.44%)	0.494 (13.06%)
Group 5	---	---	---	---	0.706 (18.34%)
OCC$_j$					
Group 1	---	6.180	5.753	5.666	5.701
Group 2	---	3.589	3.443	5.379	7.535
Group 3	---	---	16.806	3.434	3.268
Group 4	---	---	---	11.644	6.497
Group 5	---	---	---	---	10.714

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[28] For example, in the eight group solution the trajectory model estimated that 2% of the population followed a high declining trajectory. A review of the average posterior probabilities of group membership revealed that zero observations in the sample were classified into this group. Although the group is small, not classifying sample observations (on which the estimated trajectories are derived), suggests poor model fit, and raises questions as to whether the group truly exists. If there was sufficient evidence that the group exists such that the model estimates coefficients and membership proportions, the fact that no individuals in the sample sorted into this group questions its validity and highlights the model's inferior fit.

As in the pre-prison period, each post-prison model demonstrated some evidence of poor fit. At least one AvePP or OCC value in each solution falls below the recommended thresholds, indicating widespread classification error. In most cases, low AvePP are observed in groups comprised of individuals who recidivate in 1 or 2 post-prison periods. Because the full sample contains so many of these individuals, it is difficult to classify these cases. Low OCC values are slightly less concerning because they are observed only in the largest groups, which in most cases have AvePP values that suggest adequate classification. Because the OCC is scaled by the group size, higher AvePP values are needed to meet the 5.0 threshold. Still, though it appears that adding more groups to breaks up the larger groups, the OCC and AvePP values does not indicate improved model fit when a fourth or fifth trajectory group was added.

Regardless of the number of groups, all of the post-prison trajectories exhibit a declining pattern over the four-year observation period, with the exception of one flat group, located at zero[29]. It is therefore necessary to consider the substantive value added by each new group. The two-group model contains one flat non-recidivating group, and a group with a moderate declining probability of recidivism. When a third group is added, the moderate declining group splits into a lower level declining group, and a high-level declining group. With the addition of a fourth group, a second moderate declining group emerges, splitting the existing moderate declining group from the three-group solution. The addition of a fifth group has a similar result, a third moderate declining group emerges, comprising 10% of the sample. Because the four and five group models contain

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[29] In the models presented here, flat group is imposed by the zero-order trajectory group. However, modeling the post-prison trajectories with all quadratic groups reveals the same low stable group, suggesting that it exists beyond simply forcing it to exist with a zero order group.

groups which appear to be reproductions of the groups in the three-group solution with only slight variations in intercept, these models are deemed inferior.

Figure 11. Post-Prison Trajectories in the Full Sample
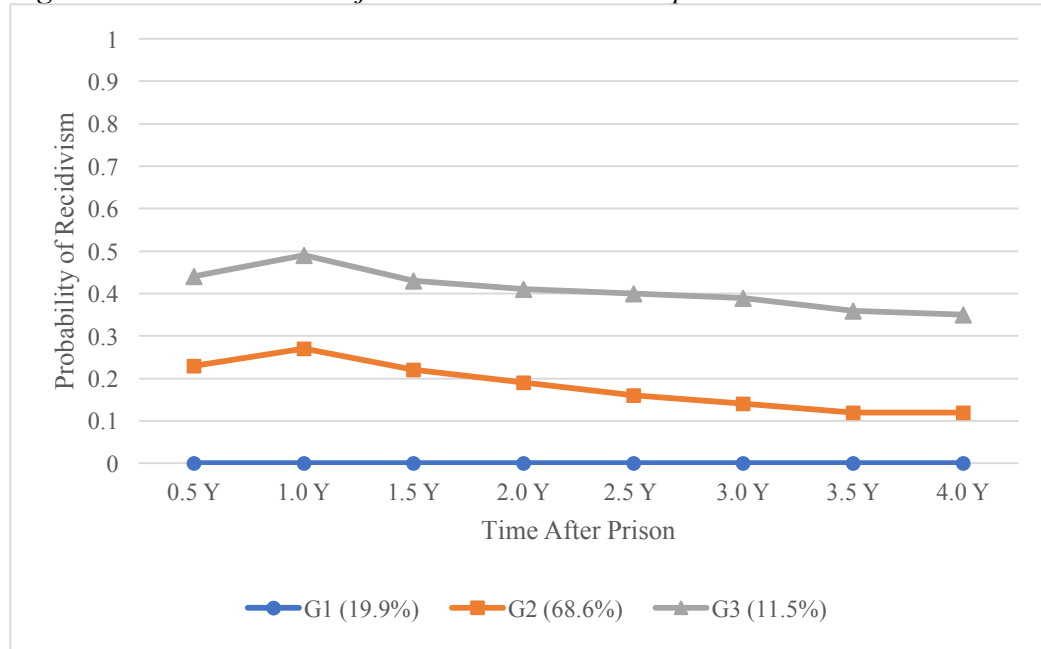
The three-group solution depicted in *Figure 11* is selected as final model for the post-prison trajectories in the full sample. The presence of a higher rate, declining trajectory is a substantively relevant recidivism group. A review of the counts of post-prison periods with recidivism events reveals that individuals classified in the high-level recidivism group recidivate in three or more post-prison intervals, suggesting that this group contains high risk individuals and that observations are correctly classified. Despite the low AvePP value in the first group of the three-group solution, this first group contains individuals with zero post-prison recidivism incidents and some individuals with only a single arrest incident. Classification error suggested by the low AvePP results from the large number of individuals with only single post-prison recidivism event, only some of whom are classified into Group 1. The OCC exceeding 5.0 suggests that classification is sufficiently accurate for this group. As such, the three-group model is selected.

Table 32. Post-Prison Exposure for the Full Sample, by Trajectory Group

Years after Release from Prison	Group 1 Average Proportion of Time on Street	Group 2 Average Proportion of Time on Street	Group 3 Average Proportion of Time on Street
0.0 to 0.5 Years	0.9986	0.9175	0.8431
0.5 to 1.0 Years	0.9995	0.7780	0.6584
1.0 to 1.5 Years	0.9996	0.6978	0.6463
1.5 to 2.0 Years	0.9999	0.6760	0.7200
2.0 to 2.5 Years	0.9999	0.6829	0.7893
2.5 to 3.0 Years	0.9999	0.6904	0.8382
3.0 to 3.5 Years	1.0000	0.7094	0.8529
3.5 to 4.0 Years	1.0000	0.7247	0.8543

Table 32 contains the average proportion of time spent on the street in each post-prison period, disaggregated by trajectory group. The second column demonstrates that for Group 1, lack of criminal activity following prison is not a result of incapacitation. Column 3 contains the exposure in each six-month interval for Group 2, the moderate declining group. The proportion of time spent in the street drops in the 6-12 months following release from prison and remains low in the post-prison period. Compared to other groups, Group 2 spends the least amount of time on the street, suggesting that part of the lower and declining recidivism probabilities may be due to incapacitation. Individuals in Group 3 are incarcerated at high rates in the beginning on the four year follow up period, but proportion of street time increases after two years of release, returning to initial levels by three-years post-release.

4.3.3. Transitions Between Pre- and Post-Prison Criminal Trajectories

Figure 12 graphically depicts how individuals transition to post-prison criminal trajectories, conditional on their pre-prison trajectory group. The conditional probabilities of group membership are found in the legend of the post-prison trajectory graphs.

Figure 12. Probabilities of Transitioning from the Three Pre-Prison Trajectories to All Three Post-Prison Trajectories in the Full Sample

Pre-Prison Trajectory Group	Post-Prison Trajectory Group

Group 1 (23.65%)

Pr (G1post|G1pre) = 0.4016
Pr (G2post|G1pre)= 0.4820
Pr (G3post|G1pre)=0.0323

Group 2 (12.37%)

Pr(G1post|G2pre)= 0.300
Pr(G2post|G2pre)= 0.632
Pr(G3post|G2pre)=0.068

Group 3 (63.98%)

Pr(G1post|G3pre)= 0.292
Pr(G2post|G3pre)=0.631
Pr(G3post|G3pre)=0.077
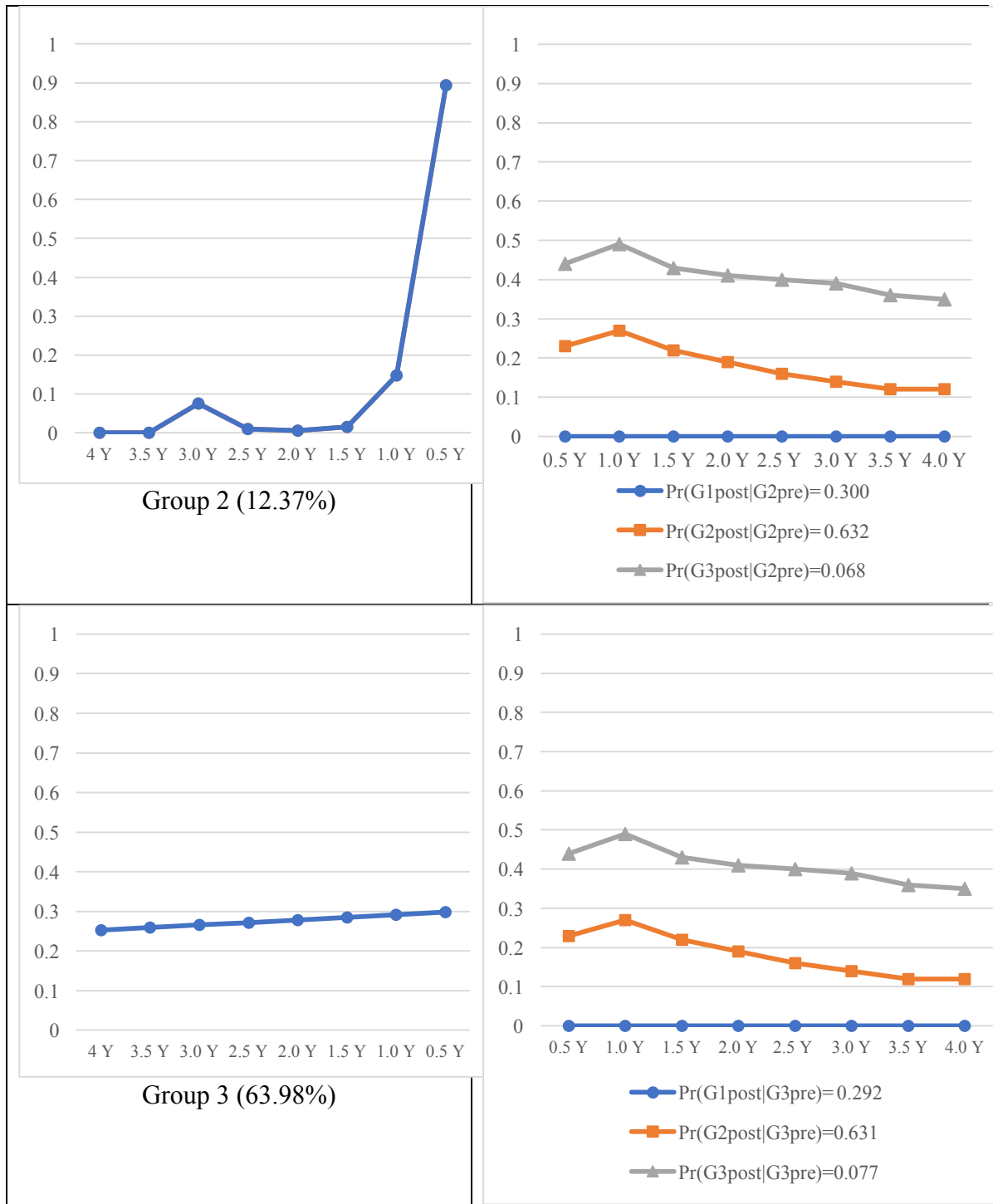
Figure 12 demonstrates that the first, low activity pre-prison group exhibits different transitioning patterns than the other pre-prison trajectory groups. The likelihood of transitioning to the non-offending post-prison group is over 10% greater when the

individuals is in the low activity pre-prison group (Group 1). For all pre-prison groups the least likely outcome is transitioning to the high post-prison group. However, for the low activity pre-prison group (Group 1), the probability of transitioning to the high post-release trajectory group is less than one-half of the conditional probability observed in the other two groups. The transition probabilities for the second and third pre-prison groups are remarkably similar. In both groups, individuals are most likely to transition to the moderate, declining recidivism trajectory, and least likely to transition to the high declining post-prison trajectory group.

To classify transitions as positive or negative turning points in the full sample, the same criteria outlined in Section 4.2 were used. These criteria and the classified transitions are presented in *Table 33* below. Columns 1 and 2 contain the pre- and post-prison average probabilities of arrest or recidivism. Columns 3 and 4 contain the predicted probabilities of arrest or recidivism in the six months preceding and following imprisonment, as a way to assess discontinuity. Columns 5 and 6 provide qualitative descriptions of each group, derived from the trajectory pattern as well as the proportion of time on the street in the pre- and post-prison periods. Column 7 describes how the transition was classified. Column 8 contains the joint probability of group membership, indicating the proportion of the full sample that experienced each transition.

Table 33. Transition Classification in the Full Sample

Transition	(1) Pre-Prison Avg. (SD)	(2) Post-Prison Avg. (SD)	(3) Est. Prob. 6 Mo. Prior	(4) Est. Prob. 6 Mo. Post	(5) Qual. Description (Pre)	(6) Qual. Description (Post)	(7) TP?	(8) Joint Prob.
1. G1[*] Post & G1 Pre	0.099 (0.169)	0.00 (0.00)	0.05	0.00	Low Activity	Non-offending	Pos.	0.0422
2. G2 Post & G1 Pre	0.099 (0.169)	0.181 (0.052)	0.05	0.23	Low Activity	Moderate Declining, Incapacitation	Neg.	0.0890
3. G3 Post & G1 Pre	0.099 (0.169)	0.409 (0.042)	0.05	0.44	Low Activity	High Declining	Neg.	0.0096
4. G1 Post & G2 Pre	0.143 (0.288)	0.00 (0.00)	0.893	0.00	Incapacitated/ High Activity	Non-offending	Pos.	0.1359
5. G2 Post & G2 Pre	0.143 (0.288)	0.181 (0.052)	0.893	0.23	Incapacitated/ High Activity	Moderate Declining, Incapacitation	---	0.1631
6. G3 Post & G2 Pre	0.143 (0.288)	0.409 (0.042)	0.893	0.44	Incapacitated/ High Activity	High Declining	Neg.	0.0109
7. G1 Post & G3 Pre	0.276 (0.015)	0.00 (0.00)	0.299	0.00	Moderate Stable Activity	Non-offending	Pos.	0.1603
8. G2 Post & G3 Pre	0.276 (0.015)	0.181 (0.052)	0.299	0.23	Moderate Stable Activity	Moderate Declining, Incapacitation	---	0.3468
9. G3 Post & G3 Pre	0.276 (0.015)	0.409 (0.042)	0.299	0.44	Moderate Stable Activity	High Declining	Neg.	0.0424

* G*X* is an abbreviation for Group X. Pre- and Post- refer to the pre-or post prison trajectory group. For example, "G1 Pre" stands for Group 1 in the pre-prison trajectory solution. In the table title, "Est. Prob." Refers to the estimated probability of arrest/recidivism in the trajectory period indicated. "Qual" is an abbreviation for qualitative description. "TP?" stands for turning point and represents whether the transitions was categorized as a turning point.

Of the nine possible transitions between pre- and post-prison trajectory groups in the full sample, three were deemed indicative of a positive turning point, four indicated a negative turning point, and two did not demonstrate clear evidence of discontinuity consistent with any turning point. Per this classification scheme, 33.84% of the full sample experience a change in offending that indicates a positive turning point. Though a greater number of transitions are classified as negative turning points (four negative vs.

three positive), only 15.19% of the full sample experiences a transition suggestive of a negative turning point. This means that most of the sample, 50.97%, exhibits no evidence of a turning point. These transition classifications are used as the dependent variable in the multinomial logistic regressions reported below.

4.3.4. Multinomial Logistic Regression

To estimate the relationship between repeated exposure to imprisonment and turning points, a multinomial logistic regression predicting positive and negative turning points was estimated with number of prior imprisonments (*Prior Prison Terms*) as an independent variable. The dependent variable in the multinomial logistic regression is a categorical outcome ranging from zero to two. Observations with a value of zero were classified as having no evidence of experiencing a turning point (i.e., they demonstrate continuity). This includes observations in transitions 5 and 8. Observations with a value of 1 are categorized as experiencing a positive turning point (transitions 1, 4, and 7). Observations with a value of 2 are categorized as experiencing a negative turning point (transitions 2, 3, 6 and 9). The control variables described in Section 3.3 are included in this model[30].

The results of this regression are presented in *Tables 34* and *35*. In *Table 34*, observations are weighted by their posterior probability of group membership in both the pre- and post-prison trajectory models. Weighting the regressions by the PPGM is important here because it circumvents some concerns raised by classification error present in the trajectory models. Because group membership is probabilistic (and because the groups approximate heterogeneity in criminal behavior rather than real patterns that

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[30] Due to multicollinearity, a binary indictor of program participation was employed rather than individual program types. Additionally, to capture misconduct, the rate and type of misconduct was used instead of a binary indicator of any misconduct.

individuals follow), weighting allows each observation to contribute to the regression estimates depending on the level of classification error. For instance, an individual with PPGM of 0.9 would contribute twice as much as an individual with a PPGM of 0.45. Because PPGM weights exist in both the pre- and post-prison trajectory models, a combined PPGM score was created by adding the PPGM from each model. As such the weight variable ranges from 0-2. Individuals classified with high accuracy in both the pre- and post-prison period have weight values closer to 2.0. Adding the PPGM together account for cases in which classification accuracy is high in one trajectory model but low in another.

In Stata 14 it is not possible to estimate a multinomial logistic regression with weights and bootstrapped standard errors (StataCorp, 2017). Since both are needed to correct for classification error and the fact that the dependent variable is an estimated quantity (see Chapter 3), separate regressions were run with bootstrapped standard errors. *Table 34* presents the results of the model with only the PPGM weights and *Table 35* contains unweighted regression results with bootstrapped standard errors (with 500 reps). In both tables, regression coefficients were exponentiated to generate odds ratios. In the first two columns, the base outcome in the multinomial logistic regression is 0, meaning that estimates demonstrate the change in odds associated with exhibiting discontinuity associated with a turning point (positive or negative) relative to no discontinuity. In the third column, the base category is changed to the negative turning point category. Odds ratios in this column reflect the change in odds of observing discontinuity suggesting a positive turning point relative to a discontinuity suggesting a negative turning point, so the odds ratios above 1.0 indicate a positive relationship (e.g. the odds increase relative to

the base outcome) and odds ratios below 1.0 indicate a negative relationship (e.g. the odds of observing the outcome decline relative to the base category). Larger divergence from 1.0 indicates a stronger relationship.

Table 34. Weighted Multinomial Logistic Regression Results Predicting Positive and Negative Turning Points in the Full Sample

Variable	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age at Admission	1.0308**	0.0020	0.9975	0.0026	1.0333**	0.0028
Prior Imprisonments	0.8134**	0.0136	1.1553**	0.0175	0.7041**	0.0139
Male	0.7840**	0.0429	1.3943**	0.1232	0.5624**	0.0519
Race/Ethnicity [1]						
Black	0.8288**	0.0311	1.4656**	0.0709	0.5655**	0.0519
Hispanic	1.1084*	0.0580	0.8680*	0.0614	0.8146*	0.0616
Other Race	1.3058	0.2760	0.9213	0.3193	1.4662	0.5125
Marital Status [2]						
Married	1.0231	0.0046	0.8859*	0.0514	1.1549	0.0735
Divorced	0.7636**	0.0449	0.8742	0.0749	0.8734	0.0805
Commitment [3] Offense- Violent	1.3286**	0.0685	1.4626**	0.0965	0.9084	0.0665
Commitment Offense- Property	0.7409**	0.0394	1.0833	0.0725	0.6839**	0.0518
Commitment Offense-Drug	1.3259**	0.0685	1.0702	0.0668	1.2389**	0.0846
Halfway House	0.6965**	0.0205	1.1333**	0.0363	0.8011**	0.0368
Initial Parole Supervision [4]						
Medium	0.8163**	0.0335	0.8983	0.0450	0.9086[+]	0.0517
Maximum	1.2814**	0.0534	0.8218**	0.0522	1.5593**	0.1030
Parole Length	0.9490**	0.0059	0.9659*	0.0075	0.9825[+]	0.0090
Time Served	1.1529**	0.0119	0.8906**	0.0155	1.2944**	0.0245
Misconduct Rate	0.9534**	0.0115	1.0410**	0.079	0.9137*	0.0121
Misconduct Type [5]	0.9284	0.0563	1.037	0.0612	0.8952	0.0682
Violent	0.9958	0.0471	1.1396*	0.0576	0.8386**	0.0527
Property	0.7946**	0.0615	1.0503	0.0736	0.7566**	0.0719
Drug						
Disciplinary Custody	0.4923**	0.1030	1.0378	0.1162	0.5850*	0.1352
Custody Score	0.6122**	0.0205	0.9596	0.0353	0.6265**	0.0277
Any Programs	0.8982*	0.0459	0.7695*	0.0493	1.1672*	0.0825

** $p<0.01$, * $p<.05$
1. Reference Category is White inmates
2. Reference Category is Single
3. Reference Category is Other Commitment Offense
4. Reference Category is minimum parole supervision
5. Reference Category is other misconduct type
Note: "TP "is an abbreviation for "turning point"

Table 35. Multinomial Logistic Regression Results Predicting Positive and Negative Turning Points in the Full Sample with Bootstrapped Standard Errors

Variable	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age at Admission	1.0312**	0.0020	0.9962	0.0026	1.0351**	0.0028
Prior Imprisonments	0.8114**	0.0125	1.1504**	0.0176	0.7054**	0.0125
Male	0.7785**	0.0375	1.3789**	0.1224	0.5645**	0.0526
Race/Ethnicity [1]						
Black	0.8334**	0.0307	1.4667**	0.0726	0.5683**	0.0293
Hispanic	1.1205*	0.0589	0.8645*	0.0608	0.8074*	0.0579
Other Race	1.3042	0.2776	0.8571	0.3336	1.5216	0.5712
Marital Status [2]						
Married	1.0150	0.0406	0.8929*	0.0492	1.1368+	0.0746
Divorced	0.7564**	0.0417	0.8712	0.0772	0.8682	0.0816
Commitment Offense-Violent [3]	1.3360**	0.0678	1.4166**	0.0854	0.9431	0.0671
Commitment Offense-Property	0.7428**	0.0391	1.0866	0.0719	0.7865**	0.0718
Commitment Offense-Drug	1.3273**	0.0673	1.0646	0.0674	1.2468**	0.0761
Halfway House	0.6891**	0.0223	1.1398**	0.0376	0.7914**	0.0370
Initial Parole Supervision [4]						
Medium	0.8127**	0.0322	0.8991*	0.0454	0.9039+	0.0515
Maximum	1.2750**	0.0582	0.8261**	0.0477	1.5434**	0.1085
Parole Length	0.9487**	0.0058	0.9643*	0.0068	0.9838+	0.0090
Time Served	1.1550**	0.0110	0.8969**	0.0141	1.2878**	0.0231
Misconduct Rate	0.9553	0.0108	1.0389**	0.0075	0.9195*	0.0122
Misconduct Type [5]						
Violent	0.9195	0.0539	1.0303	0.0604	0.8924	0.0674
Property	0.9550	0.0445	1.1309**	0.0554	0.8445*	0.0535
Drug	0.7840**	0.0639	1.0519	0.0709	0.7453**	0.0741
Disciplinary Custody	0.4926**	0.1008	1.0390	0.1284	0.5788*	0.1339
Custody Score	0.5949**	0.0204	0.9688	0.0329	0.6140**	0.0304
Any Programs	0.8815*	0.0481	0.7800**	0.0482	1.1301+	0.0797

** p<0.01, *p<.05

1. Reference Category is White inmates
2. Reference Category is Single
3. Reference Category is Other Commitment Offense
4. Reference Category is minimum parole supervision
5. Reference Category is other misconduct type
Note: "TP" is an abbreviation for "turning point"

A comparison of *Tables 34* and *35* reveals no substantive differences in the findings when weights are included and when bootstrapped standard errors are used without weights. Although there are slight changes in the magnitude of the odds ratios and standard errors reported, the significance levels and direction of all relationships remain the same. These results suggest that the findings are robust to various model specifications, adding credibility to the findings.

To assess whether repeated exposure to imprisonment is associated with positive or negative turning points, turning point classifications are regressed on the number of prior imprisonments. Panel A's coefficient indicates that an additional prior imprisonment decreases the likelihood of observing a positive turning point relative to no behavioral change by roughly 20% (p<0.001). The coefficient estimate in Panel B indicates that an additional prior prison term increases the odds of observing a negative turning point relative to no turning point by approximately 16% (p<0.001). Panel C reflects the odds of observing a positive turning point relative to a negative turning point. The odds ratio suggests that additional prior imprisonments decrease likelihood of observing a positive turning point relative to a negative turning point by 30% (p<0.001). Together, these results provide consistent support for Hypothesis 2A, which states that repeated exposure to imprisonment increases the likelihood of observing a negative turning point. This finding is robust to the inclusion/exclusion of covariates capturing aspects of the imprisonment experience, as well as to the presence of PPGM weights account for uncertainty in trajectory group classification.

Although treatment heterogeneity is not a main focus of this work, it is worth noting some patterns that were consistently observed across the control measures. All

patterns discussed are significant at the level p<0.01. *Tables 34 and 35* reveal that male and Black inmates are more likely to exhibit discontinuity in arrest and recidivism that is reflective of negative turning points relative to both positive turning points and no turning. Compared to those who are single, inmates married at the time of release from prison are less likely to exhibit evidence of a negative turning point relative to no turning point. Conversely, divorced inmates are less likely to exhibit evidence of positive turning point relative to no turning point. Time served and classification to higher custody levels in prison increases the likelihood of observing a positive turning point and decreases the likelihood of a negative turning point. With respect to parole supervision, additional years on parole decreases the likelihood of observing evidence of both positive turning point and a negative turning point relative to no turning point. Release to a halfway house decreases the likelihood of observing a positive turning point and increases the odds of a negative turning point relative to no change. Chapter 5 offers a more thorough consideration of these patterns, and their value in understanding imprisonment as a turning point.

4.3.5. Summary- Cumulative Disadvantage/Repeated Exposure to Imprisonment

In the repeat prisoner sample, imprisonment served as a positive turning point in 39% of cases, and a negative turning point in 32% of cases. Comparatively, less than 3% of first time prisoners exhibit evidence of a negative turning point, lending support to hypothesis 2A, which states that negative turning points are more common among repeat prisoners. This pattern is confirmed in the multinomial logistic regressions reported in section 4.3.4. Additional prior imprisonments significantly increase the odds of observing discontinuity associated with a negative turning point relative to no behavioral change

and relative to a positive turning point. Additional prior imprisonments also decrease the odds of experiencing a transition consistent with a positive turning point.   Taken together, these results are consistent with the cumulative disadvantage perspective. The odds of observing evidence of negative turning points increased among repeat prisoners and with additional prison stays, which may suggest that criminogenic impact of imprisonment grows with repeated exposure.

The results do not support hypothesis 2B, which states that first-time prisoners are more likely to experience imprisonment as a turning point than repeat prisoners. Though 45% of first time prisoners exhibit discontinuity in offending before and after prison, most first time prisoners do not demonstrate offending patterns consistent with any turning point. By contrast, over 70% of repeat prisoners experience a change in offending before and after prison that indicates a turning point.   This suggests that first time imprisonment, though impactful, is less influential for offending than repeated incarceration.

4.4. The Timing of Imprisonment

The second goal of this research is to determine how the timing of imprisonment relates to whether imprisonment appeared to serve as a positive or negative turning point. Hypothesis 3 states that imprisonment is more likely to serve as a negative turning point when it occurs earlier in the life course, particularly if it occurs during emerging adulthood. To assess the role of timing, a continuous measure of age is included in the multinomial logistic regressions predicting turning points presented in *Table 34 & 35*. Across all three models, age significantly distinguishes positive and negative turning points. Panel A suggests that when imprisonment occurs later in the life course, the odds

of observing a positive turning point relative to no turning point increase. More specifically, imprisonment occurring one year later in the life course is associated with 3.2% increase in the odds of exhibiting a positive turning point relative to no turning point ($p<0.001$). Panel C demonstrates that as age at admission to prison increases, the likelihood of observing a positive turning point relative to a negative turning point also increase ($p<0.001$). This means that younger age at imprisonment increases the odds of observing a discontinuity in offending consistent with negative turning point relative to no turning point. However, age at admission to prison does not significantly distinguish negative turning points from non-turning points. This finding directly contradicts hypothesis 3, which states that negative turning point are more likely when imprisonment occurs earlier in the life course. With mixed evidence, these analyses do not clearly support hypothesis 3.

Though a continuous measure of age demonstrates the relationship between age and turning points, a continuous measure does not capture the substantively relevant group: individuals imprisoned during emerging adulthood (ages 22-25). To determine whether imprisonment during emerging adulthood is unique, a binary age measure capturing imprisonment between the ages of 22 and 25 replaced the continuous age measure in the multinomial logistic regression analyses. Roughly 13% of the sample falls into this age range (N=3,901).

The results of the multinomial logistic regression are presented in *Tables 36* and *37*. Both models control for all covariates present in the previous estimation, but the covariates coefficients are omitted here. *Table 36* displays the regression results

estimated with PPGM weights and *Table 37* reports the results with bootstrapped

standard errors (without weights).

Table 36. Weighted Multinomial Logistic Regression Results Containing Binary Age Measure in the Full Sample

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		c) Positive TP vs Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age 22-25	0.6598**	0.0301	0.8040**	0.0462	0.8207**	0.0534

***p<0.01, **p<0.05

Table 37. Multinomial Logistic Regression Results Containing Binary Age Measure and Bootstrap Standard Errors in the Full Sample

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		c) Positive TP vs Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age 22-25	0.6495**	0.0301	0.8243**	0.0489	0.7880**	0.0491

***p<0.01, **p<0.05

The results portrayed in *Table 36* and *37* are substantively similar to the results in

Table 37, when a continuous age measure was employed. Panels A suggests that the odds

of observing positive compared to no turning points are lower for individuals age 22-25.

Stated differently, individuals imprisoned between ages 22 and 25 are more likely to

exhibit evidence of no turning point compared to evidence of a positive turning point. In

contrast to the prior analyses with a continuous age measure, the odds of exhibiting

evidence of a negative turning point relative to no turning point are lower for individuals

age 22-25. This finding directly contradicts with hypotheses 3. However, the odds of

exhibiting discontinuity in offending consistent with a positive turning point compared to

a negative turning point decrease when individuals are imprisoned between ages 22 and

25. This means that those imprisoned during emerging adulthood are more likely to

exhibit evidence of a negative turning point than a positive turning point. Together, the

regressions suggest that the role of age in determining whether prison serves as a turning

is complex. While older age at imprisonment increases the odds of observing a positive turning point, age at admission to prison does not distinguish negative turning points from non-turning points. Although imprisonment between ages 22-25 increases the odds of observing a negative turning point relative to a positive turning point, individuals imprisoned in emerging adulthood are less likely to exhibit a negative turning point than no turning point.

4.4.1. Summary: The Timing of Imprisonment

Taken together, evidence regarding the timing of imprisonment is mixed. Hypothesis 3 states that imprisonment is more likely to serve as negative turning point when it occurs earlier in the life course. Age at admission to prison does not significantly distinguishes negative turning points from non-turning points, but does increase the odds of observing a positive turning point relative to a negative turning point. This means that earlier imprisonment reduces the increases of observing a negative turning point relative to a positive turning point. The latter pattern was also observed with a binary age measure. When comparing among individuals who exhibit any discontinuity in offending, imprisonment during emerging adulthood increased the odds of exhibiting a negative turning point, suggesting that imprisonment may be more detrimental during this time in the life course.

However, utilizing the binary measure of emerging adulthood also suggested that individuals in the transition to adulthood are more likely to experience non-turning point transitions relative to the rest of the sample. Imprisonment during emerging adulthood increased the odds of observing non-turning points relative to either positive or negative turning points. Paired with evidence that age at admission to prison increases the odds of

observing a positive turning point, it would appear that imprisonment is more likely to alter the life course when it occurs later in life, rather than earlier.

4.5. The Timing of First and Repeat Imprisonment

Hypothesis 4 states that first time imprisonment is more likely to yield offending amplification when it occurs earlier in the life course (specifically during emerging adulthood). To test this hypothesis, I return to the trajectory models utilizing first-time and repeat prisoners separately. Transitions between pre- and post-prison trajectories resulting from the first-time and repeat prisoner samples are utilized as dependent variables in the multinomial logistic regressions, and measures of age at imprisonment serve as the primary independent measures. Regressions were weighted by the pre- and post-prison posterior probability of group membership from the respective dual trajectory models (*Tables 38 & 40*). A second set of analyses contain bootstrapped standard errors with 500 replications (*Table 39 & 41*). The results from the first-time prisoner sample are presented first, followed by the same regressions estimated in the repeat prisoner sample.

Table 38. Weighted Multinomial Logistic Regression Predicting Turning Points in the First-Time Prisoner Sample

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age at Admission	1.0306**	0.0024	0.9822*	0.0077	1.0493**	0.0083

**p<0.01, *p<0.05

Table 39. Multinomial Logistic Regression Predicting Turning Points in the First-Time Prisoner Sample with Bootstrap Standard Errors (500 Reps)

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age at Admission	1.0309**	0.0023	0.9828*	0.0077	1.0489**	0.0080

**p<0.01, *p<0.05

The results of the regression employing the first-time prisoner sample are presented in *Tables 38 & 39*. Panel A contains the multinomial logistic regression estimates comparing the positive turning point outcome to continuity in offending behavior. The age coefficient is significant and positive, suggesting that as age at admission to prison increases, the likelihood of observing first-time imprisonment as a positive turning point increases relative to observing no evidence of a turning point. The positive relationship between age and positive turning points also emerges in Panel C. First time imprisonment occurring one year later in the life course significantly increases the odds of observing a positive turning point relative to a negative turning point, for first time prisoners. These patterns were also exhibited in the full sample.

Panel B reveals that the odds of observing a negative turning point relative to a non-turning point decreases with age at admission to prison. Stated differently, this result suggests that individuals imprisoned for the first time earlier in the life course are more likely to exhibit evidence of a negative turning point compared to no turning point. This pattern was not observed in the full sample. Discrepancy between the two regressions stem from the differences in the trajectory solutions in the first-time prisoner and full samples. The dependent variable in each regression is not the same because the transitions between trajectory groups are not the same. This divergence in findings highlights the importance of looking beyond the full sample (or the average trajectories in a sample), and the importance of disaggregating analyses by relevant subgroups. Heterogeneity in the relationship between age and imprisonment would be missed if only the full sample was considered.

The binary age measure reveals more nuance in the relationship between age at admission to prison and turning points. *Tables 40 and 41* demonstrate that the odds of observing a positive turning point relative to no turning point are lower for individuals are imprisoned for the first time between ages 22 and 25. This relationship is consistent with prior findings that positive turning points are more likely among individuals are first imprisoned for later in life.

Individual imprisoned between the ages of 22 and 25 are also significantly more likely to exhibit evidence of a negative turning point than a positive turning point. This suggests that first-time imprisonment is more detrimental when it occurs during emerging adulthood. However, going to prison for the first time between the ages of 22 and 25 is unrelated to the odds of observing a negative turning point relative to no turning point. Though *Tables 38 and 39* suggested that age at admission to prison decreases the odds of observing a negative turning point, this pattern appears to be restricted to individuals imprisoned after age 25.

Table 40. Weighted Multinomial Logistic Regression Predicting Turning Points in the First-Time Prisoner Sample—Binary Age Measure

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age 22-25	0.7085**	0.0374	1.0608	0.1429	0.6678**	0.0940

**p<0.01, *p<0.05

Table 41. Multinomial Logistic Regression Predicting Turning Points in the First-Time Prisoner Sample with Bootstrap Standard Errors (500 Reps)—Binary Age Measure

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age 22-25	0.7057**	0.0382	1.0474	0.1505	0.6747**	0.1378

**p<0.01, *p<0.05

Tables 42 and 43 contain the multinomial logistic regression results for the repeat prisoner sample. Timing of repeat imprisonments significantly associated with both positive and negative turning points. Panel A demonstrates that as returning to prison one year later in the life course increases the odds of observing a positive turning point relative to no turning point by almost one-percent (0.7%, p<0.01). p<0.05). Panel C demonstrates that older age at admission to prison significantly increases the odds of observing discontinuity in offending consistent with a positive turning point relative to a negative turning point. By contrast, returning to prison at an older age decreases the odds of observing a negative turning point relative to no turning point. Stated differently, returning to prison earlier in the life course increases the odds of observing a negative turning point compared to a positive turning point. Taken together, this suggests that the timing of repeated imprisonment matters for offending change.

Table 42. Weighted Multinomial Logistic Regression Predicting Turning Points in the Repeat Prisoner Sample

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age at Admission	1.0072*	0.0033	0.9921**	0.0033	1.0152**	0.0030

**p<0.01, *p<0.05

Table 43. Multinomial Logistic Regression Predicting Turning Points in the Repeat Prisoner Sample with Bootstrap Standard Errors (500 Reps)

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age at Admission	1.0073*	0.0032	0.9920**	0.0034	1.0154**	0.0029

**p<0.01, *p<0.05

The binary age measure provides a more nuanced view the timing of repeat imprisonment (Tables 44 and 45). Experiencing repeat imprisonment between the ages of 22 and 25 is unrelated to the odds of observing a positive turning point, relative to both

no turning point and a negative turning point. Interestingly, the odds of observing a negative turning point relative to no turning point are significantly lower for individuals returning to prison at this age. The odds of observing a negative turning point (relative to no turning point) are higher for younger individuals, but only individuals returning to prison after age 25. Again, it appears that imprisonment during emerging adulthood is more commonly associated with no turning point than either a positive or negative turning point.

Table 44. Weighted Multinomial Logistic Regression Predicting Turning Points in the Repeat Prisoner Sample—Binary Age Measure

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age 22-25	0.8763	0.0803	0.8132**	0.0724	1.0776	0.0928

**p<0.01, *p<0.05

Table 45. Multinomial Logistic Regression Predicting Turning Points in the Repeat Prisoner Sample with Bootstrap Standard Errors (500 Reps)—Categorical Age Measure

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age 22-25	0.8708	0.0783	0.8219*	0.10758	1.0595	0.1017

**p<0.01, *p<0.05

4.5.1 Summary: Timing of First and Repeated Imprisonment

The analyses presented in Section 4.4 provide evidence to support Hypothesis 4. I predicted that negative turning points are more common first-time imprisonment occurs at a younger age, particularly if it occurs during emerging adulthood. *Tables 40 and 41* confirm that the odds of observing a negative turning point relative to no turning point or a positive turning point decrease with age at admission to prison, meaning that younger first-time prisoners are more likely exhibit negative turning points than no-turning points or positive turning points. This pattern was not limited to first-time prisoners. Returning

to prison earlier in the life course increases the odds of exhibiting a negative turning point compared to no turning point in the repeat prisoner sample as well.

Interestingly, the odds of observing a negative turning point do not increase if imprisonment (first time or otherwise) occurred during emerging adulthood (ages 22-25). Contrary to hypothesis 4, first time and repeat imprisonment between ages 22 and 25 decreased the odds of observing a negative turning point relative to no turning point. This suggests that increased odds of observing a negative turning point relative to no turning point are limited to individuals imprisoned after age 25.

Finally, for both first-time and repeat prisoners, the odds of observing a positive turning point increased with age at admission to prison. Imprisonment between the ages of 22 and 25 significantly decrease the odds of observing a positive turning point relative to no turning point for both samples. These findings were replicated in the main sample.

Section 4.6. Final Results Summary

The goal of this research is to determine whether or not prison serves a turning point in the criminal career, for whom, and under what conditions. Hypothesis 1 states that imprisonment serves as a turning point in the criminal career. The dual trajectory and post-estimation analyses provide evidence that imprisonment can serve as turning point in the criminal career for some. In the full sample, 49% of parolees demonstrated discontinuity in their transition from a pre-prison trajectory group to a post-prison trajectory group. Forty-four percent of first time prisoners exhibit evidence of either a positive or negative turning point and almost 70% of repeat prisoners exhibited evidence of either a positive or a negative turning point. Although the majority of the full sample and first-time prisoners exhibit no turning point, I consider hypothesis 1 is supported

because large portions of each sample exhibit either a positive or negative turning point. Additionally, there is much heterogeneity in how prison serves as a turning point. Across all samples, larger portions of the sample exhibit evidence of a positive turning point than a negative turning point in the criminal career. The proportion of negative turning points is distinct across the samples; 15% of the full sample, 2.3% of first time prisoners and 35% of repeat prisoners exhibit discontinuity in offending consistent with a negative turning point. This variation supports hypothesis 1A, which states that the extent to which imprisonment serves as a turning point in the criminal career varies across subgroups.

Hypothesis 2A suggests that repeat prisoners are more likely to experience imprisonment as a negative turning point than are first-time prisoners. Descriptively, repeat prisoners offend less in the pre-prison period than first time prisoners, but recidivate more often in the post-prison period, suggesting more amplification of criminal behavior. Indeed, a notably larger portion of the repeat prisoner sample experienced transitions categorized as negative turning points relative to the first-time prisoners (33.5% versus 2.3% respectively). Multivariate analyses also demonstrated that, in the full sample, additional prior imprisonments increased the odds of observing a negative turning point relative to both a positive turning point and no turning point.

Hypothesis 2B states that first-time imprisonment is more salient than repeat imprisonment, meaning that first-time imprisonment is more likely to serve as a positive or a negative turning point than repeat imprisonment. Even though first-time prisoners were slightly more likely to experience a positive turning point than repeat prisoners (42.5% vs. 39%, respectively), hypothesis 2B is not supported. Most first-time prisoners

(55%) do not exhibit evidence of any turning point, whereas 70% of repeat prisoners do exhibit evidence of a turning point.

Hypothesis 3 predicts that the experiencing imprisonment earlier in the life course, particularly during emerging adulthood, increases the likelihood of observing discontinuity associated with a negative turning point. The findings provide mixed support for hypothesis 3. In the full sample, age at admission to prison was not significantly associated with the odds of observing a negative turning point relative to no turning point. Individuals imprisoned between the ages of 22-25 were *less* likely to exhibit evidence of a negative turning point relative to no turning point, directly contradicting hypothesis 3. However, age at admission to prison increased the odds observing a positive turning point compared to a negative turning point, meaning that younger age at imprisonment increases the odds of observing a negative turning point relative to a positive turning point. Conversely, in both the repeat and first-time prisoner samples, younger age at admission significantly increases the odds of observing a negative turning point relative to no turning point, suggesting that imprisonment of younger individuals is uniformly associated with offending amplification.

Despite somewhat mixed evidence for the relationship between age and negative turning points, sections 4.4 and 4.5 clearly indicates that older age at admission to prison increases the likelihood of observing a positive turning point compared to no turning point. It therefore appears that the timing of imprisonment matters, the relationships are far from straightforward.

Hypothesis 4 states that first-time imprisonment is most likely to result in a negative turning point for younger inmates, particularly if it occurs during emerging

adulthood. The results in section 4.5 support this hypothesis. In the first-time prisoner sample, younger age at imprisonment increased the odds of observing a negative turning point, relative to no turning point or a positive turning point. However, imprisonment during the transition to adulthood was not related to the odds of observing a negative turning point relative to no turning point among first-time prisoners, suggesting that the inverse relationship between age at imprisonment and negative turning points is restricted to first-time prisoners over the age of 25. These patterns were not limited to first-time prisoners. The odds of observing a negative turning point relative to no turning point decreased with age at admission to prison in the repeat prisoner sample as well.

CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

5.1. Considering the Findings

This study set out to identify discontinuities in offending (as captured by arrest and recidivism) before and after prison that may be indicative of turning points in the criminal career. Given competing theoretical perspectives and extant empirical literature, the direction of change was largely unknown a priori. For this reason, hypotheses 1 and 1A stated that imprisonment serves as a turning point in the criminal career, and that there is variation in how imprisonment relates to criminal behavior depending on the subgroup in question. I predicted that prior prison terms may increase the likelihood of observing a negative turning point, if the collateral consequences of imprisonment add up over time (Hypothesis 2A). I also acknowledged the possibility because imprisonment involves socialization to a new environment, which can be traumatic, that its impact may be concentrated at the first prison stay, meaning that first-time imprisonment is more likely to serve as a turning point that repeated imprisonment (Hypothesis 2B). Because imprisonment is a disruptive experience that removes individual from their communities, families, and employment, I also hypothesized that imprisonment (first-time or otherwise) would be more damaging when it occurs earlier in the life course, and particularly during emerging adulthood, as opportunities to acquire social capital could be cut off (Hypotheses 3 and 4). To evaluate these hypotheses, I used dual trajectory models to estimate patterns of offending in the four years before and after a prison term in Pennsylvania. If there was evidence of discontinuity in arrest and recidivism, transitions among trajectory groups were classified as either indicative positive or negative turning points depending on the direction of change in criminal behavior

(reduction or amplification). If there was not clear evidence of discontinuity in arrest and recidivism according to the criteria outlined in Chapter 3, the transition was considered a non-turning point. *Table 46* summarizes the proportion of each sample that experienced each type of turning point. To evaluate hypothesis 1, I begin by discussing trends in turning points in the full sample, and then describe the nuances revealed amongst first time and repeat prisoners.

Table 46. Distribution of Turning Points in Each Sample

	Percent Positive TP	Percent Negative TP	Percent No TP
Full Sample	33.85%	15.19%	50.97%
First Time Prisoners	42.47%	2.31%	55.2%
Repeat Prisoners	39.96%	35.52%	24.65%

Though there was evidence of discontinuity in arrest and recidivism, there was also clear suggestions of continuity in criminal justice involvement. Indeed, nearly half of the prisoners did not exhibit enough change in arrest and recidivism to clearly infer a positive or negative turning point. With the empirical and theoretical justifications to expect prison serves as turning point presented in Chapter 2, this was less discontinuity than was initially expected. On one hand, evidence continuity in arrest and recidivism before and after prison could indicate that there is no effect of imprisonment on criminal behavior, as suggested by some research (e.g. Green & Winik, 2010; Loughran et al., 2009). High proportions of each sample exhibiting no behavioral change support's Nagin and colleagues' (2009) assessment that on average prison has no effect on criminal behavior at the individual level. On the other hand, it may be that the strategy to determine behavioral change in this study did not catch all discontinuity. Recall the criteria for distinguishing transitions as a positive and negative turning points included

the comparing estimated probabilities of arrest and recidivism in the six months before and after prison, the average probability of arrest and recidivism in the four years before and after prison, the declining and increasing slopes of the trajectory groups, and the amount of time spent on the street. When there was conflicting evidence regarding the direction of behavioral change or sufficient evidence based on the standards set forth in Chapter 3, transitions were categorized as non-turning points. The high prevalence of non-turning points could therefore be a product of the criteria used to classify transitions. Group based trajectory modeling also tends to produce flat or gradually changing trajectories that may overstate stability in behavior compared to other methods used to discern change (Bushway et al., 2009). This occurs because the trajectory patterns are biased toward the group average, and classification error increases when variability is "spiky" or patterns rapidly change (Bushway et al., 2009). It also possible that lack of variability in the probability of arrest and recidivism generated from official records did not contain enough variation to discern change. This is concerning because official statistics generally miss instances of criminal behavior (Mosher et al., 2010). Moreover, because solutions with few groups were preferred by the model fit statistics (two or three groups), it is also possible that individuals with dissimilar patterns were grouped together simply because there was not enough variation to estimate another group with sufficient accuracy. Because only additional work using an array of alternative methodological approaches can provide insight on whether the lack of discontinuity observed is an artifact of the group based trajectory approach, one should view these results as suggestive of continuity, rather than clearly indicative of it.

The prevalence of behavioral continuity before and after imprisonment does not mean that prison does not serve as a turning point in the criminal career. The results of this dissertation suggest that prison may serve as a turning point, but not for everyone. When there are discontinuities in arrest and recidivism indicative of a turning point, there is evidence of change consistent with both positive and negative turning points. In the full sample, 33.84% of parolees exhibit evidence of a positive turning point and 15.19% demonstrate a pattern that suggests a negative turning point.

Changes in arrest and recidivism suggestive of positive turning points are consistent with the deterrence and/or rehabilitative frameworks. Imprisonment is a severe sanction, so individuals may be discouraged from committing crime in the future to avoid additional punishment. Across all samples, multinomial logistic regressions suggested that time served in prison and release to maximum parole supervision increased the odds of exhibiting a positive turning point relative to no turning point, or a negative turning point, corroborating the deterrence framework. Moreover, individuals engaged in programming during the focal imprisonment were more likely to exhibit positive turning points relative to negative turning points, suggesting that some may be rehabilitated while inside. It is also possible that the causal mechanisms behind behavioral changes are not uniform; some individuals may be deterred while other are rehabilitated. Unpacking when or how prison results in a positive turning point may help the criminal justice officials structure prison and parole experiences to promote reductions in future criminal behavior. Though this dissertation serves as a first step toward informing those discussions, the results here should be interpreted only tentatively. No conclusions are

causal and much more research on imprisonment as a turning point is needed before policy change is warranted.

To be clear, evidence of a positive turning point should not be equated with evidence of desistance. Desistance is defined as the permanent cessation of offending (Sampson & Laub, 1993; Bushway et al., 2003; Bushway et al., 2009). In this study, positive turning points capture only reduction in recidivism after prison compared to a pre-prison arrest pattern. Some turning points classified as positive involve offending in the post-prison period. Although between 15% and 30% of each sample exhibit no criminal justice contact in the post-prison period, with only a four-year post-prison trajectory period, it is difficult to assume complete or permanent cessation in offending. Future analyses with longer follow up periods are needed to distinguish positive turning points emblematic of desistance from positive turning points that reflect only reduction in arrest or recidivism[31]. Future research must also investigate these mechanisms and the conditions under which prison can promote desistance, as this information is important for criminal justice policy.

Roughly 15% of the full sample exhibited evidence of amplified offending in the post-prison, consistent with a negative turning point. There are many reasons why imprisonment may serve as a negative turning point, and the multinomial logistic regression results provide some insight as to the potential processes at play. The odds of exhibiting evidence of a negative turning point (compared to no turning point) were higher among those who engage in higher rates of misconduct, or more serious

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[31] Bushway and colleagues (2009) suggest that desistance is measured as five-year period when the probability of offending is indistinguishable from zero, preceded by at least a five-year period with a non-zero probability of offending. With four-year pre- and post-prison period, this study does not contain a sufficient time frame to determine desistance per Bushway's standard.

misconduct (drug and violent infractions) while in prison. Spending a larger portion of the focal imprisonment in disciplinary custody also increased the odds of observing a negative turning point compared to a positive turning point. Misconduct signals maladjustment to the prison environment, meaning that prison may be more traumatic for these individuals and subsequent offending increases could be attributed to the adverse impact of the prison environment. Extant literature on segregation also links time spent in disciplinary custody to recidivism (e.g. Mears & Bales, 2009), although the mechanisms behind this relationship are unknown.

Additionally, individuals released onto maximum parole supervision or halfway houses, were more likely to experience a negative turning point relative to no turning point. Those serving longer parole sentences were also more likely to experience a negative turning point than no turning point. Stricter post-release monitoring by the criminal justice system may lead to greater detection of criminal behavior for this group. If this is true, higher levels of offending upon release may reflect differential opportunities to observing recidivism rather than a real change in behavior.

The combination of maximum parole supervision level, release to a halfway house, and longer parole terms means that the department of corrections views a parolee as a high recidivism risk, requiring greater scrutiny in a community setting. In PA, parole supervision levels are determined almost entirely by the pre-release LSI-R score (Austin et al., 2003). The LSI-R is a validated risk assessment tool that incorporates a parolee's prior criminal history, commitment crime, family relationships, employment or financial stability, residence, and substance use upon release to predict future crime. Negative turning points may be an artifact of higher criminal propensity. In other words, those who

experience a negative turning point may be more serious criminals. Though the dual trajectory model accounts for some unobserved heterogeneity in criminal propensity by classifying individuals in to pre-prison groups based on their prior offending, conditional group membership cannot fully account for differences in criminal propensity. It is therefore plausible that relationship between prison and discontinuity in behavior may spurious. Future research should seek to explore selection processes operating behind positive and negative turning points.

The presence of both positive and negative turning points, and non-turning points in offending before and after prison implies that *there is no universal effect of imprisonment or monolithic behavioral change following prison*. Studies that restrict the relationship between prison and crime to a single estimate (e.g., propensity score matching designs, fixed effects regressions) miss this variation, and oversimply what is actually a more complex relationship.

The complexity of the relationship between prison and crime is further evidenced by the presence of treatment effect heterogeneity demonstrated in this research. Distinct trajectory patterns and transitions among groups emerged in the full sample, first-time prisoner sample, and repeat prisoner sample, demonstrating the importance looking beyond the average relationship and disaggregating by relevant subgroups. Both prior prison history and age significantly distinguish positive and negative turning points from each other, and from non-turning points. Each is described below. Although these are the only two moderators considered in this work, it is possible that other sources of variation exist. I revisit this possibility in the discussion of future research directions below.

5.1.1. Cumulative Disadvantage and Repeated Exposure

The dual trajectory models presented in Chapter 4 suggest that prison may serve as a turning point for both first time and repeat prisoners. Evidence of turning points is more common among repeat prisoner sample, as almost 75% of repeaters demonstrate discontinuity in arrest and recidivism, compared to 45% of first time prisoners. Turning points are not only more common among repeat prisoners, they are also more heterogeneous. First time prisoners almost uniformly experience positive turning points. Specifically, 42% of first time prisoners exhibit positive turning points while only 2.3% experience a negative turning point. By contrast, 39% and 33% of repeat prisoners exhibit discontinuities in arrest and recidivism consistent with positive and negative turning points, respectively.

Multinomial logistic regressions revealed that the odds of observing a negative turning point relative to no turning point or a positive turning point increased with additional prior prison terms. Amplification in criminal offending appears more common when individuals are sent to prison more than once. Consistent with a cumulative disadvantage perspective, these results suggest the criminogenic "effect" of imprisonment builds with repeated exposure. Paired with evidence that first time prisoners are less likely to experience negative turning points (only 2.3% of the first-time prisoner sample compared to 33% of the repeat prisoner sample), the implication of these findings is that a single prison term is not likely to amplify offending; instead, if imprisonment serves as a negative turning point, it is more likely to occur over time with multiple stays. These patterns and relationships remain consistent when individuals imprisoned at or after ages

20 and 21 were added to the main analytic sample, and when the pre-prison trajectory period was shortened. These robust patterns support hypothesis 2A.

This pattern could be observed for a variety of reasons. Multiple prison stays could increase the volume or diversity of criminal capital, and provide an inmate with more skills and opportunities to offend upon release (Bayer et al., 2009; Morsellli & Trembaly, 2004; Nguyen et al., 2016). Although custody level and time served do not significantly increase the odds of observing a negative turning point relative to no continuity for repeat prisoners, both these factors do increase the odds of observing a negative turning point relative to a positive turning point. Insofar as custody level and misconduct rates capture peer influence and learning processes in prison, these correlates lend preliminary support to the criminal capital hypothesis.

Repeated removal from the community and/or periods of parole supervision may also strain social capital and personal relationships, increasing post-imprisonment criminal behavior. The work of Pager (2003) and Holzer (1996) suggests that most employers are reluctant to hire individuals with criminal records and incarceration history. Though first time imprisonment can be inferred as a single lapse of judgement from which the offender learns his or her lesson, repeated incarceration may be evidence of failure to change. After the second or third prison stay, it may be more difficult to hold down a job if employers assume the individual is unreliable or dangerous. Without post-release employment, ex-inmates may be at high risk of recidivism because they not have the financial means to live a crime free life (Western et al., 2015). Repeated imprisonment may also present additional challenges for marital and family relationships (Geller & Walker, 2012; Travis et al., 2014; Turney & Wildeman, 2012). Incarceration of

a partner is often accompanied by financial and emotional stress, which may deteriorate existing relationships if experienced consistently over time. Weaker bonds after imprisonment may explain amplification in offending observed in the repeat prisoner sample, and with additional prison terms. In the present study, inmates who were married were less likely to exhibit discontinuity in offending consistent with a negative turning point, relative to no turning point. Similarly, divorced individuals are less likely to exhibit evidence of a positive turning point, relative to no turning point. Though these data cannot discern when divorce or marriage occurred or if relationship status changed after release, the patterns suggest that stronger social bonds decrease the odds of offending amplification, whereas weak bonds could explain negative turning points. Additional data regarding pre- and post-prison employment and relationships statuses are needed to discern the intervening processes behind negative turning points. Future research should seek to collect data on pre- and post-release social capital to assess the validity of these claims.

While the criminogenic impact of imprisonment may build over time, evidence of positive turning points appears slightly stronger at the first prison stay. Not only are first time prisoners more likely to exhibit evidence of a positive turning point than repeat prisoners, the number of prior prison terms decreases the odds of observing a positive turning point. This means that the odds of observing a positive turning point relative to no turning point are highest when an individual has zero prior prison terms. This pattern could be observed because the criminogenic impact of prison is weakest at first imprisonment, or because the first prison stay has a larger deterrent or rehabilitative capacity. The latter statements are tentatively supported in *Table 2A*, which captures

heterogeneity in the imprisonment experience, disaggregated by imprisonment history. First time prisoners serve longer sentences (which have greater deterrent capacity) and participate in more rehabilitative programming. Qualitatively different prison experiences may account for the distinct transitions observed in the first time and repeat prisoner samples.

Although discontinuity consistent with positive turning points is slightly more common among first time prisoners than repeat prisoners, most first-time prisoners do not exhibit evidence of any turning point. Turning points over all are more common in the repeat prisoner sample. This remains true when adding individuals imprisoned at age 20 and 21 to the sample and shortening the pre-prison trajectory period, suggesting the finding is robust. Therefore, it cannot be said that first-time imprisonment is more likely to result in a turning point, either positive or negative, than repeat imprisonment. Despite evidence that first-time imprisonment can be a turning point, hypothesis 2B is not supported.

5.1.2. Timing of Imprisonment

Consistent with the life stage principle, this research demonstrates that the impact of imprisonment as a turning point is not uniform across the life course. The age at which an individual was admitted to prison, whether for the first time or not, significantly changes the odds of observing discontinuities in offending consistent with positive and negative turning points. *Table 47* below summarizes these relationships for reference.

Table 47. Multinomial Logistic Regression Results Indicating How Age at Admission to Prison Changes the Odds of Observing Discontinuities Consistent with Turning Points, Disaggregated by Analytic Sample [1]

Age Measure*	Positive TP vs. No TP	Negative TP vs. No TP	Positive TP vs. Negative TP
Full Sample			
Age at Admission	Increases Odds	No Change	Increases Odds
Age 22-25	Decreases Odds	Decreases Odds	Decreases Odds
First Time Prisoners			
Age at Admission	Increases Odds	Decreases Odds	Increases Odds
Age 22-25	Decreases Odds	No Change	Decreases Odds
Repeat Prisoners			
Age at Admission	Increases Odds	Decreases Odds	Increases Odds
Age 22-25	Decreases Odds	Decreases Odds	No Change

1. All changes in odds are significant at p<0.05. These results are derived from Chapter 4 only.

*Age at Admission is a continuous measure of age at admission to prison, measured in years. Age 22-25 is a binary indicator capturing admission to prison between these ages.

One indication of the importance of the timing of imprisonment is apparent when considering positive turning points. Across all iterations of the dual trajectory model, older age at admission to prison increases the odds of observing discontinuity reflective of a positive turning point, relative to no turning point or a negative turning point. This relationship was consistent across first-time and repeat prisoners, when individuals imprisoned at age 20 and 21 were added to the sample, and with the shortening of the pre-prison trajectory period. Higher odds of observing a positive turning point with age were also confirmed when a categorical age measure capturing imprisonment during emerging adulthood (ages 22-25) was used. Imprisonment during this point in the life course decreased the odds of observing a positive turning point relative to no turning point and a negative turning point. The inverse relationship between age and crime demonstrated here is consistent with empirical work that document desistance from crime with age. Explanations for the age crime relationship are numerous. Some argue that individuals "age out" of crime through natural maturation, while others claim that bonds

developed later in life significantly reduce criminal behavior (Gottfredson & Hirschi, 1990; Laub & Sampson, 2003; Sampson & Laub, 1993). With respect to imprisonment, it is possible that the deterrent impact of imprisonment is delayed until later in life (Cusson & Pinsonneault, 2014). If older offenders estimate higher costs associated with imprisonment, or higher risk of punishment in general, they may be more likely to make a rational decision to desist from crime following a severe punishment like a prison stay (Cusson & Pinsonneault, 2014). Maguire (1982) finds that the prison experience is more stressful for older individuals, some even report that it was easier to be incarcerated at a younger age. Any of these factors may increase the likelihood that older inmates experience prison positive turning points.

It is important to note that differences in offending progression could be a result of a maturational processes that are unrelated to the experience of prison. This is a concern here, because the age patterns observed are consistent with the age crime curve. It is possible that older individuals are more likely to demonstrate behavior consistent with a positive turning point because they are naturally aging out of crime through a universal desistance process (Gottfredson & Hirschi, 1990; Laub & Sampson, 2003). This study captures individuals at a single point in the criminal career, and by consequence, may demonstrate more positive behavioral change among older prisoners simply because they are farther along in the desistance process. More research is needed to disentangle age differences is criminal behavior from the process of aging, and distinguish any spurious relationships.

The relationship between age at imprisonment and negative turning points is slightly less clear. The continuous measure of age at admission to imprisonment is not

related to the odds of observing a negative turning point relative to no turning point in the full sample[32]. However, in both the first-time and repeat prisoner samples, age at imprisonment was negatively related to the odds of observing a negative turning point relative to no turning point, meaning that younger individuals are more likely to exhibit evidence of a negative turning point. Though slightly counterintuitive, this discrepancy results from differences in the trajectory solutions across samples. Recall that the dependent measures in each regression model are the classified transitions among pre- and post-prison trajectory groups, which vary in each analytic sample. This differences highlight the importance of disaggregating the sample by relevant subgroup, because variation in the relationship between age and offending amplification would have been missed. But the discrepancy also shows the fragility of the findings regarding negative turning points. The relationships are not consistent across samples or age-ranges (see *Appendix A*), meaning that conclusions should be interpreted with caution.

Compared to positive turning points, the odds of observing a negative turning point decrease with age. This relationship was demonstrated across all analytic samples. So, although age does not distinguish negative turning points from non-turning points, it appears that younger age at imprisonment increases the odds of exhibiting a negative turning point compared to a positive turning point. These relationships provide tentative support for Hypothesis 3, which suggests that imprisonment is more likely to serve as a negative turning point when it is experienced earlier in the life course.

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[32]Appendix A highlights the instability of this relationship. When adding individuals imprisoned between the ages of 21 and 22 to the sample, and shortening the pre-prison period to 3 years, older age at imprisonment significantly decreased the odds of observing a negative turning point. This might suggest that younger inmates are more likely to exhibit a negative turning point. However, when the pre-prison period was shortened to 2 years, and individuals imprisoned at or after age 20 were added, the relationship between age at imprisonment and negative turning points was positive, but insignificant. Findings regarding negative turning points should be viewed with caution given this instability.

Contrary to hypothesis 3, however, individuals imprisoned during emerging adulthood (ages 22-25) are less likely to exhibit evidence of a negative turning point relative to no turning point (in the full sample and first-time prisoner samples). It appears that higher odds of discontinuity reflective of a negative turning point among younger inmates may be restricted to individuals imprisoned after age of 25. Continuity in arrest and recidivism pattern among young adult offenders suggests that they are less impacted by the imprisonment experience, for better or for worse. This finding contradicts evidence that early adulthood is a formative time for development. Despite the fact the completing education, gaining employment, and getting married are most likely to occur between age 20 and 30, imprisonment at the same time (and therefore restriction in the opportunities for form those bonds) does not seem to influence criminal offending. It is possible that younger adults are simply more resilient to experiences, and therefore more likely to exhibit consistency in behavior. As individuals age they develop social bonds, many of which can be disrupted or severed entirely by the imprisonment experience. The dissolution of bonds or social capital may be more profound after emerging adulthood, because individuals had more time to accumulate and invest in prosocial relationships prior to imprisonment, whereas for younger individuals, those bonds may be newer and weaker. As such, individuals imprisoned outside the transition to adulthood may exhibit offending amplification upon release when the weight of broken bonds is realized. In a study of military service, Elder (1986) finds joining the military later in life is was more detrimental than joining earlier because older men completed education, gained employment, and started families, so they experienced more disruption in prosocial

relationships. The same is also possible for older prisoners. Prison and parole may be more disruptive later in life if existing bonds are destroyed.

The dual trajectory model and post-estimation methods employed do not allow for an assessment of the causal relationship between prison and crime, or the mechanisms driving the behavioral change observed. The distinction between conceptual and methodological causality is important here. In a theoretical sense, claiming that imprisonment serves as a turning point in the criminal career presupposes a causal relationship. All theoretical perspectives invoked in this work hypothesize that imprisonment causes changes in crime, so rationale for studying imprisonment as a turning point in the criminal career stems from these theories that posit a causal relationship (conceptual causality). Here, it is only possible to identify the correlates of various types of discontinuity in arrest and recidivism, so previous interpretations of turning points and why they may be observed are only speculation. This is to say, without methodological causality, my conclusions that there was evidence as a turning point should not be interpreted that there was evidence that imprisonment caused a change in criminal trajectories. Though I do find evidence that imprisonment may serve as a turning point, and that the nature of the turning point depends on inmate age and imprisonment history, this research alone should not be used as a basis for policy decisions regarding how to foster certain types of turning points. Similarly, this dissertation should not be viewed as a test of any of the previously mentioned theories. Other methods establishing a causal relationship between imprisonment and crime, and an assessment of heterogeneity in this relationship are needed to adequately test criminological theories and before any policy change is warranted.

5.2. Critical Assessment of the Dual Trajectory Approach

The previous discussion of this dissertation's findings presupposes that the analytic approach utilized in this study was correct and adequate for discerning behavioral change and turning points. There are certainly theoretical and analytic reasons for using a dual group based trajectory model in the study of turning points. The advantages of this approach are outlined in Section 2.4 of this document. Briefly, the major benefits of utilizing a dual trajectory approach in the study of prison as a turning point are threefold: 1) operationalizing behavioral change as a change in a long term pattern of behavior occurring coincident to the entrance to/exit from prison, 2) the assessment of heterogeneity in both offending patterns and how parolees transitions among pre- and post-prison criminal trajectories, and 3) the within-person design does not rely on comparisons between individuals who may not be comparable in unmeasurable ways. The dual trajectory approach also provides an intuitive way to connect pre- prison and post-prison offending trajectories which allows for an assessment of change in offending relative to a previous pattern. It also provides an assessment of heterogeneity not offered by other methodologies, and provides context as to whom, and under what conditions different types of turning points are observed. In these ways, the dual trajectory approach can serve as an important supplement to the extant literature on turning points, addressing some attributes of turning points that other methods do not. Still, given the challenges incurred in this research, it is important to reassess/recount the utility of this method. To do so, I will first describe each challenge, review how it was handled analytically, and then discuss the consequences of those analytic choices.

First, the data reveal low levels of variability in criminal behavior in both the pre- and post-prison periods, for example, the average probability of arrest or recidivism in any trajectory period was low (often below 0.2). This indicates that small portions of the sample were arrested or recidivated in each trajectory period. Moreover, roughly 90% of individuals were arrested or recidivated in fewer than three out of eight trajectory periods, both before and after prison. Such few instances of arrest and recidivism were surprising in a prisoner sample, particularly because other studies demonstrate more evidence of offending with comparable samples (e.g. Tahamont et al., 2015). Low variability in criminal behavior may result from the fact that the data contain only officially recorded criminal behavior, or because official records were available only for a single state. Because juvenile arrest records were not available, I only looked at criminal behavior in a four-year period. Thus, these data may contain only part of each individual's criminal history and underestimate the probability of arrest or recidivism. Expanding the time frame or including other indicators of offending may have increased incidents of arrest and recidivism, thus adding variability and increasing the number of groups that could be estimated with accuracy. Without additional data sources, these limitations cannot be addressed in the current study. Future research should seek to validate these data by using self-reported criminal behavior from a prisoner sample before and after prison.

The limited variation is also partly a function of measuring criminal behavior dichotomously and using a logistic regression to estimate the trajectory model. By reducing the measure of crime in each six-month interval to a binary measure, heterogeneity in the frequency of arrest or recidivism is lost. The count measures of arrest and recidivism revealed that over 90% of observations exhibited one or fewer

arrests in five of the eight pre-prison periods and four of the eight post-prison periods. Because of skewness in arrest and recidivism counts and lack of variability in frequency I chose to dichotomize the outcome measure and use a logistic regression for the trajectory estimation. It is possible that modeling the counts of arrest or recidivism could reveal additional variation missed by a dichotomous measure.

One result of the low levels of variation in arrest and recidivism is that the trajectory model picks up on changes in the timing of the few criminal incidents rather than gradual shifts in the probability of criminal justice involvement. There is not enough change in the probability of arrest or recidivism because so many of the observations have no criminal justice contact in most trajectory periods. For example, in the pre-prison model for the full sample, what distinguishes groups 1 and 2 is the timing of arrests-arrest occur either in the 6 months immediately preceding imprisonment (Group 2) or in the 6-12 months prior to imprisonment (group 1). Contrary to the rationale for using the dual trajectory approach, the model does not capture the progression of offending over time, whether gradual or abrupt, but instead captures the timing of criminal events.

Another, more important, consequence of low variation in arrest and recidivism is classification error. With low variability in arrest and recidivism, fewer trajectory groups can be added to the model without convergence issues or increasing classification error. Because large portions of the sample have no arrest or recidivism in many pre- and post-prison intervals, the trajectory model has difficulty differentiating these cases from one another and placing them into distinct trajectory groups. Each trajectory solution contained one or two groups demonstrating a low probability of arrest/recidivism, and one moderate stable group, because the only variation that is reliably discerned is the

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difference between those who are arrested or recidivated once or twice, and those who are arrested/recidivated more. When additional groups are added, individuals who look very similar are separated into different groups unreliably. If membership in a pre- or post-prison trajectory group is highly uncertain, it is possible that turning points are improperly inferred because individuals could reasonably belong to trajectory groups that do not exhibit change. Take, for example, an individual who has a 0.5 posterior probability of membership in two pre-prison trajectory groups and a posterior probability of 0.98 in a post-prison trajectory group. If transitioning from the first pre-prison trajectory group to the post-prison group is deemed a positive turning point, but transitioning from the second pre-prison group to the post-prison group is deemed no turning point, then it is unclear whether this observation exhibited evidence of a turning point. The observation is equally likely to exhibit both transitions. This is problematic because all of this study's analyses rely on the transitions between trajectory groups. If observations are classified into a pre- or post-prison trajectory that does not reflect their criminal activity, comparisons regarding the proportion of each sample exhibiting positive or negative turning points would not accurately represent the data. Because the multinomial logistic regressions rely on the transitions between trajectory groups, the relationships between prior imprisonments and age at admission to prison discussed above would also be called into question, potentially leading to improper conclusions regarding cumulative disadvantage and the timing of imprisonment.

To reduce chances of misclassification, I selected trajectory solutions with fewer groups wherein classification accuracy was sufficient or independently validated (for example by considering the distribution of arrests in each group). Additionally, post-

estimation probability weights were included in the multinomial logistic regressions to adjust estimates and account for classification error. With these adjustments, concerns about bias resulting from classification error are lesser, but one should still be cautious interpreting the findings.

A second challenge faced during this research involved accounting for the proportion of time spent on the street in the pre- and post-prison periods (or exposure time). To properly estimate criminal behavior in the pre- and post-prison periods, it is important to know when individuals are on the street and able to get arrested or have their parole revoked (exposed), and when they are incapacitated because of incarceration. Efforts to account for exposure were partly inhibited by measurement error. Because other data were not available, the exposure measure in this study only included time spent incarcerated in a state prison. Any time spent in jail, a hospital, a parole violator center, or any other institutional setting was not included, which means that time on the street was overstated. Had any exposure variable been included in the trajectory models, these data limitations would have resulted in an incomplete measure of time on the street.

Attempts to include exposure time into the trajectory model itself, in the form of a time varying covariate, presented classification and convergence issues (these issues are outlined in *Appendix B*). *Appendix B* demonstrates that including a time varying measure of exposure time into the trajectory models resulted in "spiky" trajectories wherein the predicted probabilities of arrest fluctuated repeatedly rather than exhibiting gradual change. Maximum likelihood estimation strategies have difficulty handling such radical variation, and classification error rises. Bushway and colleagues (2009) find that group based trajectory models do not capture intermittent offending well; abrupt changes in the

probability of criminal behavior tend to be "smoothed" out because the trajectory model weights observations toward the sample average. When the exposure variable is included, the trajectory models become more intermittent and "spiky" because many individuals exhibit arrest/recidivism when on the street, and cannot exhibit criminal behavior when incarcerated (e.g. the probability of arrest drops to zero). In addition, classification accuracy diminished with the addition of the exposure variable. As stated above, because this research endeavor relies heavily on the transitions between trajectories groups, credible classification into each trajectory group is particularly important to ensure that individuals are appropriately labeled as experiencing turning points or not. The choice was made to prioritize classification accuracy and estimate the trajectory models without the exposure variable. Without additional data, it simply is not possible to discern whether the problems imposed by the exposure covariate were specific to these data, or would be a general issue in the estimation of any trajectory model.

The inability to include exposure time in the trajectory estimation means that the trajectory models do not measure criminal behavior during time on the street. Instead, the patterns returned in the trajectory estimation procedure are a composite measure of time on the street and time incarcerated. *Declines in criminal behavior cannot be unconditionally interpreted as reductions or desistance, but could be driven by incapacitation.* To avoid inappropriately classifying transitions as emblematic of turning points, I consider descriptive statistics of exposure time to determine the extent to which each trajectory pattern may be driven by incapacitation. Cautious or conservative determinations were made. In the presence of evidence that time on the street could explain increases or declines in criminal behavior, a transition was not deemed a turning

point. For example, in the full sample, the three-group post-prison trajectory solution contained a stable non-recidivating group, a low to moderate declining group, and a high declining group. Transitions to the non-recidivating group were classified as evidence of a positive turning point, because individuals in this trajectory group spent more than 95% of each post-prison period on the street. By contrast, although a low declining pattern was observed in the second group, over 20% of most post-prison periods was spent re-incarcerated. As such, the declining probability of arrest and low probability is not clearly indicative of reductions in offending, but instead is could be underestimated due to less time on the street. As such, transitions to the moderate declining post-prison trajectory were not deemed a turning point.

This analysis heavily relied on descriptive criteria to determine if a turning point occurred. While describing how trajectories differ in the pre- and post-prison periods is a valid way to determine discontinuity in arrest and recidivism, it is still a subjective endeavor. It is possible that another researcher, with different necessary and sufficient criteria for determining turning points or different interpretation of the trajectory patterns may draw different conclusions as to which transitions are emblematic of turning points. Additionally, if the trajectory patterns look different with other data, then new criteria may be needed entirely if the metrics used here are not relevant in another context. Because classifying turning points is such a central piece of this analysis, this subjectivity is not ideal. Although the criteria employed in this study were reasonable given the data at hand, subjectivity in turning point classifications means that standardization across turning point studies would be difficult, which certainly poses challenges for replication.

Complicating matters further, turning point determinations are dependent on the trajectory models themselves, which are a product of the analytic choices made by researchers. These choices include (but are not limited to) selecting the appropriate the number of groups, the polynomial order, the addition of covariates to the trajectory models, sampling strategies, the length of the trajectory period, and the type of data used. For example, the increasing or decrease pattern observed over a trajectory period are determined by the polynomial order. If a cubic order is selected, the trajectory line will change direction twice, whereas a linear specification will result in a straight line. If two turning point studies utilize different orders, the transitions derived may vary because of this analytic choice. Comparing turning point studies becomes more difficult when different data sources are used. For example, if one dual trajectory models are estimated with self-reported criminal behavior rather than official records, incidence of crime may be higher, and more trajectory groups with distinct patterns may emerge. Consistently determining turning points across models with different trajectory specification and data would be challenging. As such, turning point determinations in a dual trajectory model must be made on a model by model basis, because when the trajectory models differ in these ways they are not directly comparable.

Some of these challenges are exemplified in the current study; even with consistent polynomial order, trajectory period lengths, and outcome measurements across three samples, three unique sets of transitions emerged. In the repeat prisoner sample, shortening the length of the pre-prison period starkly changed the character of the trajectory solution; new patterns and transitions emerged (see *Appendix A*). Moreover, though classifying these transitions as turning points was based on somewhat

standardized criteria across models in this study, regression models revealed distinct relationships between age at admission to prison and turning points in the full sample, and in the disaggregated repeat and first-time prisoner samples. Clearly, the sampling strategy matters for the conclusions drawn. These examples serve to highlight that analytic choices made in the construction of the dual trajectory model can alter the study's findings.

In the future, new or additional metrics to determine whether a turning point occurred in the dual trajectory framework should be considered to allow for comparison across models and outcomes. With other data, it may be possible to utilize equality of coefficient tests to determine if the intercept of trajectories differ, or if trajectories are increasing and declining at different rates. Another possibility is to model the dependent variable as a count rather than a binary measure of crime. Using the Poisson or zero inflated Poisson distribution in the trajectory estimation would allow the researcher to see if the number of arrests in the pre- and post-prison periods increase or decrease. Comparing frequencies is more concrete and intuitive way to assess behavioral change rather than relying on changes in the probability of any crime, which is more abstract.

5.3. Other Limitations

Additional sampling and data limitations warrant further discussion. The sample included individuals released from Pennsylvania prisons onto parole supervision between January 1st, 2006 and December 31st, 2008. The results of this analysis are not generalizable to prisoner samples from other states, or to PA prisoners released at a different time. This analysis also pertains only to discretionary parole releases. No conclusions can be drawn about individual who serve their entire prison sentence and are

released from prison unconditionally ("max outs"). Research suggests that individuals max out their prison sentences either because they are consistently denied released by the parole board, or because they chose to stay in prison and do not attend parole hearings despite eligibility. Compared to individuals who are released onto parole, max outs are typically higher risk, in that they committed more serious crimes, have longer prior records, and all else being equal, recidivate more often (Osterman, 2012). If this is true of max outs excluded from the current study, then in addition to limited generalizability, post-release criminal behavior may be underestimated for the sample, resulting in less variation in criminal justice contact and fewer groups in the trajectory models. The exclusion of max outs from this study also means that prison is not the only "treatment" that the sample experiences. Everyone in the sample goes to prison and serves a portion of their sentence on parole supervision. The turning point, then, is just not prison, but includes prison and parole.

This study also cannot speak to whether prison serves as a turning point for individuals imprisoned as juveniles or before the age of 20. Because juvenile arrest records were not obtained, in the main analysis, the sample was also restricted to individuals imprisoned when they were at least 22 years old. Sensitivity analyses in Appendix A extended this main sample to include individuals imprisoned at age 20 and 21, respectively, and no distinct results emerged. Although necessary, this sampling restriction prohibits conclusions regarding the relationship between prison and crime for younger individuals. Because the timing of imprisonment was a central focus of this study, only including adult prisons is problematic. Life course studies stress the importance of considering how crime progresses from early in life, through adolescence

and into adulthood and old age. This study can only speak to the adult portion of the life course, and whether prison serves as a turning point if it experienced during adulthood. It is possible that including younger individuals may reveal different trajectory groups or age patterns. To fully integrate the life course criminology and the study of imprisonment, differential impact of imprisonment should be assessed across a wider portion of the life course. Concerns about the age of the sample may be tempered by the fact that imprisonment is almost exclusively an adult phenomenon. Detention in adolescence, below the age of majority, occurs in different institutions. Including youth incarcerated in state prison because of juvenile waiver would not provide a representative picture of how adolescents respond to prison, because they comprise such a small select portion of the youth population.

As previously stated, this study uses only official records of criminal behavior compiled by Pennsylvania criminal justice agencies. These official records which miss criminal events that are not known to PA police, or that are not linked to the appropriate individual. Here, estimates of arrest and recidivism are more seriously underestimated because official records of crime include only arrests and prison stays in the state of Pennsylvania. Failing to capture arrests or incarceration stays in different states is problematic with Pennsylvania's geographic location. Many of Pennsylvania's largest cities are located at the state's border, making it easy for individuals to move across state lines and be caught up in the justice system of New Jersey, Delaware, or Ohio. For example, Philadelphia is PA's largest city with the highest crime rates and concentration of prisoners. Philadelphia is located directly across the Delaware River from Camden, New Jersey, and access to Camden is not difficult. Though nationally, an average 10% of

parolees commit crimes in other states, this proportion may be higher in PA because of its geographic location and the concentration of high crime in cities close to state lines. Future research should seek to expand the sources of official records used to determine criminal behavior. FBI rap sheets should be incorporated to develop a more complete picture of offending. Official records should also be validated with self-reported offending information.

5.4. Future Directions

Both theoretical and analytic advances are needed to fully integrate the studies of life course criminology and imprisonment. Tentative evidence that prison can serve as a turning point for some, and that the quality of the turning point may vary, warrants further investigation of how criminal behavior changes before and after prison. It is important to assess the mechanisms behind different types of behavioral change, and to investigate new ways of discerning whether change occurred. The dual trajectory model and post-estimation analyses employed in this research serve as only one way to assess whether prison is a turning point in the criminal career. Though the model allows researchers to capture certain attributes of turning points not measured with other methodological approaches (e.g. longitudinal patterns of criminal behavior before and after a proposed turning point, assessment of heterogeneity), the way the dual trajectory model was employed n this work does not address all aspects of turning points or directly link changes in criminal behavior to the imprisonment experience. Given the challenges faced in the execution of the analysis, this method should be considered as a supplement to traditional studies of turning points, and new methodological approaches should also be explored.

Considering the low levels of criminal behavior detected by the official records used in this study, it appeared that the main source of variation in criminal behavior was in its timing. If this is true, it may be appropriate to use survival analyses to model the timing of criminal events surrounding a prison experience. Although traditional survival models estimate the time to a single event, repeated hazard models (or series hazard models) allow for the consideration of multiple criminal events and "changes in risk for subsequent events conditional upon characteristics of past events and other event-specific or date-specific covariates" (Dugan, 2011, p. 380). The repeated hazard model is designed to capture changes in risk or hazard after an intervention. In the study of prison as a turning point this would mean that pre- or post-prison criminal behavior could be measured by estimating the time to arrest or recidivism events, and determining whether imprisonment increases or decreases the hazard of criminal behavior. One benefit of survival analysis is that it accounts for exposure time or censoring, so concerns regarding incapacitation are lesser in these models. Unlike other methodologies employed to study turning points (e.g. fixed effects regressions or propensity score matching), the repeated hazard framework does not reduce criminal behavior before or after the turning point to a single event or average estimate. The progression of criminal behavior as it unfolds over time is captured, and thus the model remains consistent with the life course paradigm.

One challenge to modeling imprisonment as a turning point is connecting pre-prison criminal behavior to post-prison criminal behavior such that a comparison between the two patterns can be made. The dual trajectory framework provides a statistical linkage between the two trajectories through the calculation of joint and conditional probabilities of group membership. Although the survival framework does not provide a direct way to

compare the arrest or recidivism hazards before and after prison, it may be possible to estimate the models separately in the pre- and post-prison periods, and use the pre-prison estimated hazard as a predictor of the post-prison hazard. Following similar logic, one could estimate a pre-prison group based-trajectory model and use group membership as a predictor of the post-prison recidivism hazard. Either proposed method may serve to enhance knowledge of prison as a turning point in the criminal career.

Many of the challenges faced in the present research were derived from classification error, or difficulty assigning individual cases to trajectory groups. Classification error weakens the conclusion that may be drawn from the analysis because if individuals are inaccurately assigned to groups, the turning points cannot accurately be inferred. One way to avoid error associated with group classification is to estimate trajectories without the presumption that the population is composed of discrete groups. The individual trajectory approach used by Bushway and colleagues (2009) provides promise moving forward. The authors estimated individual trajectories of offending with time series models for each observation in the sample. Like estimating a pre- and post-prison trajectory model, a time series allows for an assessment of the progression of criminal behavior over time, both before and after prison. Future work could estimate the time series with a structural break occurring at the time of imprisonment to infer whether there is a change in the time series before and after imprisonment. A structural break involves separating the time series into two parts and conducting an equality of coefficient test to reveal whether there is a change in slope (Greene, 2012). If a significant break exists at the time of imprisonment, a turning point may be inferred.

Although estimating trajectories for each observation may be computationally intensive and tedious, the individual trajectory approach minimizes error arising from group classification while still allowing for a within person assessment of behavioral change and comparison of criminal patterns before and after imprisonment. Another advantage worth noting is that the individual trajectory approach does not bias individuals' trajectories toward the group or population average. Group based trajectory modeling, on the other hand, may mask individual variation, deeming it "unnecessary noise" and presents group estimates that are heavily influenced by the average trend (Bushway et al., 2009; Osgood, 2005). Thus, the group based approach is more likely to yield flat patterns of offending, which may overstate stability on behavior (Bushway et al, 2009). More nuanced assessments of change may be gained by the individual trajectory approach, suggesting that it is a suitable alternative moving forward.

Along with pursuing new methodologies to measure prison as a turning point, additional sources of treatment effect heterogeneity should be investigated. This study focused only on inmate age and prior incarceration history as sources of variation in how imprisonment relates to crime. Theoretically, there are numerous additional sources worth considering. For example, life course criminologists argue that the duration of a turning point may determine its impact on behavior (George, 2009; Laub et al., 1998; Laub & Sampson, 2003). Although empirical evidence regarding the relationship between time served and post-release criminal behavior is mixed (e.g. Loughran et al., 2009; Nagin et al., 2009), the results of the multinomial logistic regressions presented in Chapter 4 suggest that more time in prison increases the odds of experiencing a positive turning point relative to no turning point or a negative turning point, and decreases the

odds of experiencing a negative turning point relative to no turning point. These results lend tentative support to the idea that the influence of a turning point is contingent upon its duration, but further assessment of duration dependence in prison as a turning point is needed. The results of the multinomial logistic regressions in this research also suggest that positive and negative turning points are distinguished by gender and race/ethnicity. Race and gender are robust correlates of criminal behavior and criminal justice contact and should be investigated as potential moderators of imprisonment as a turning point. The intersection of race, age, gender, and other factors should also be considered.

Finally, research should explore the sources and implications of heterogeneity in the imprisonment experience. Prison is often described as a "black box" because researchers (or the public) do not know what goes on inside (Mears, 2008). Despite naming prison a "black box" most researchers acknowledge that there is heterogeneity in the experience of prison along several dimensions. With 56 correctional systems operating in the United States, each with a different number of facilities, varying degrees of physical security, custody levels, priorities, budgets, program offerings, and geographic locations, inmates' experience can look drastically different. Still, most studies assessing the impacts of imprisonment make comparisons between people who do and do not go to prison or compare individuals who spend different amount of time in prison, implying that all who go to prison encounter the same experience. The present study is no exception. Imprisonment is not modeled directly in this analysis but is simply and event that occurs between two statistical trajectories. Though some scholars acknowledge the inappropriateness of ignoring this heterogeneity (e.g. Mears et al. 2015; Nagin et al., 2009; Tahamont & Frisch, forthcoming), lack of data on the prison

experience (both between states and within single states) hinder empirical assessment of treatment heterogeneity.

Tables 2A-2D in Chapter 4 highlights diversity in the prison experience in the present sample. Even among inmates imprisoned in the same state, and released at the same time, rank-sum tests demonstrate that prior prison history, age at admission to prison, gender, and race/ethnicity significantly predict the types of experience inmates have in prison, indicating that not all prison experiences should be considered equal. These differences in the prison experience have implications for behavior. The regressions in Chapter 4 also demonstrates that time served, custody level, segregation, and program participation significantly distinguish positive and negative turning points from non-turning points and from one another. Assessment of how the imprisonment experience differs is particularly important for the study imprisonment as a turning point because it is not reasonable to assume that qualitatively different experiences produce the same behavioral response. In future, research should identify additional sources of heterogeneity in prison experiences and assess the role of various prison experiences on criminal behavior.

Considering the challenges faced in both the trajectory estimation and the classification of transitions as turning points, along with data limitations, it is worth considering what was learned from this research and whether it was a useful endeavor in studying turning points. This dissertation demonstrates that there is evidence of discontinuity in arrest and recidivism patterns before and after prison, suggesting that prison may serve as a turning point in the criminal career. Clearly though, there is not a single relationship between imprisonment and crime. Discontinuities consistent with both

positive and negative turning points were observed in all samples and distinct distributions of these types of turning points were observed among first-time and repeat prisoners. Consistent with life course criminology, there is evidence that the impact of life events depends both on their timing, and how often they are experienced. It may be concluded that the life course paradigm offers dividends in the study of imprisonment.

This work can also be viewed as an empirical exercise assessing the appropriateness of using a dual trajectory approach to study turning points. Though challenges were faced, the dual trajectory approach offers a straightforward way to assess heterogeneity in how pre-prison arrests relate to post-prison recidivism, and by extension, allows for an assessment of a turning point. This method can supplement traditional studies of turning points by describing and comparing patterns of criminal behavior before and after prison, and capturing heterogeneity in potential turning point influences. Here, I outlined one way to classify transitions between trajectory groups as positive and negative turning points, offering one way for scholars to make these determinations in the future. With the benefits and challenges to using a dual trajectory outlined, future work can be aware of and improve upon this study's limitations.

Appendix A: Sensitivity Analyses

In the main analyses presented in Chapter 4, the dual trajectory analyses and post-estimation regressions were restricted to include only individuals who experienced imprisonment at or after age 22. This restriction was made in order to have four years' worth of data to estimate the pre-prison trajectory, because only adult rap sheet including arrests after age 18 were available. This age restriction was reasonable given the data available, but constructing a four-year pre-prison trajectory period was a somewhat arbitrary decision. If a two-, or three-year pre-prison period was utilized, the sample could include 20- and 21-year olds respectively. Given that this analysis makes specific predictions about emerging adulthood, which traditionally occurs between the ages of 18 and 25 (Arnett, 2000), including this group of younger adults may more accurately capture the theoretical construct and allow for a more accurate test of this study's hypotheses. As a sensitivity analysis, here I estimate the dual trajectory models with two- and three-year pre-prison trajectory periods to include individuals imprisoned at or after age 20 and 21 respectively.

Few differences emerged when the sample was expanded to include younger individuals. To avoid repeating the same descriptive statistics presented in Chapter 4, for each analytic (full sample, first time prisoners, and repeat prisoners) I only provide only a summary of the findings in each sensitivity analyses. More detailed results are available upon request.

6.1. Sensitivity Analysis 1: Estimating and Comparing Pre-and Post-Prison Trajectories for First Time and Repeat Prisoners

In Chapter 4, the first analysis compared the transition between pre- and post-prison trajectories for first time and repeat prisoners as a means to assess cumulative

disadvantage and repeated exposure to imprisonment. In this first sensitivity analysis, I re-estimated and compared dual trajectory models for first-time and repeat prisoners separately, including individuals imprisoned at age 21 and 20. To mirror the results presented in Chapter 4, I first report the findings from the dual trajectory models in the first-time prisoner sample, and then report the same results for the repeat sample.

6.1.1. Pre- and Post-Prison Trajectories for First Time Prisoners—Age 21+

When individuals imprisoned between the ages of 21 and 22 were added to the sample, the first-time prisoner sample increase from 13,155 observations to 14,289. With the inclusion of these observations, the average age at admission to prison reduced by one year, dropping from 33.21 (SD=9.35) sample to 32.28 (SD=9.51). In each pre- and post-prison trajectory period, the probability of arrest or recidivism increased slightly with the inclusion of younger inmates.

Pre-prison trajectories were estimated in the three years prior to first time imprisonment. Consistent with the main analysis, the models converged with up to four trajectory groups. A two-group solution was deemed superior based on the model fit statistics. This two-group model is depicted in *Figure 13*. This solution contains one large group, with a moderate, almost stable probability of arrest across the pre-prison period (63%), and a smaller group of individuals who are not arrested until two years prior to the focal imprisonment (37%).

Figure 13. Pre-Prison Trajectories for First Time Prisoners- Age 21+

Post prison trajectories were estimated in the four years following release from prison. Though the models converged up to five groups, the four- and five-group solutions demonstrated high levels of classification error and did not produce groups that added unique substantive contributions to the model (e.g. reproduced existing trends). A three-group solution, containing a non-recidivating, moderate declining, and high slightly declining group, was selected. Both the pre- and post-prison trajectory solutions mirror those in the main analysis, even with a shorter pre-prison terms and the inclusion of younger inmates.

Figure 14. Post-Prison Trajectories for First Time Prisoners- Age 21+
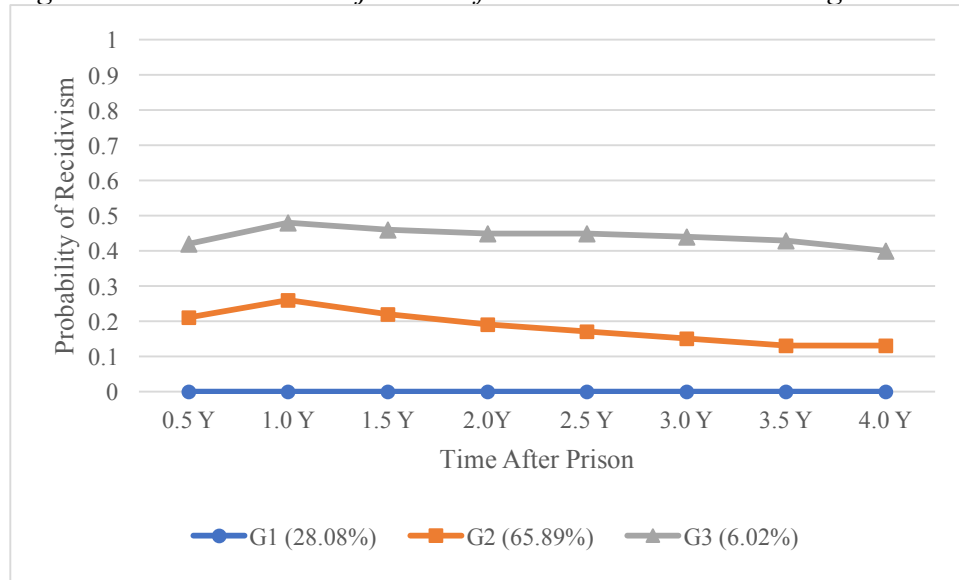
With two pre-prison trajectory groups and three post-prison trajectory groups, there are six possible transitions that could indicate a turning point. Per the classification criteria outlined in Chapter 4, two transitions demonstrated discontinuity consistent with a positive turning point, and two demonstrated discontinuity consistent with a negative turning point. As such, 41.3% of first time prisoners exhibited evidence of a positive turning point and 2.58% demonstrated evidence of a negative turning point. Most first-time prisoners (56.11%) exhibit no evidence of a turning point. This distribution is consistent with what was found in the main analysis.

6.1.2. Pre- and Post-Prison Trajectories for First Time Prisoners—Age 20+

Adding individuals imprisoned for the first time between the ages of 20 and 22 to the sample increased the sample size by 2,395 (N= 15,374). The average age at admission to prison decreased by two years (33.21 to 31.45). In each pre- and post-prison trajectory period, the probability of arrest or recidivism slightly increased by between 0.002-0.005.

In the pre-prison period, a two-group pre-prison model was selected. The solution is depicted in *Figure 15*. Shortening the pre-prison period to two years slightly shifts the

distribution of group membership. More observations are classified into the moderate stable trajectory in this model than in previous analyses (77% vs. 65%). This could be a function of group membership in the younger sample (imprisoned before age 22) or could result because the patterns that emerge over 2 years are less distinct, and individuals switch groups.

Figure 15. Pre-Prison Trajectories for First-Time Prisoners- Age 20+
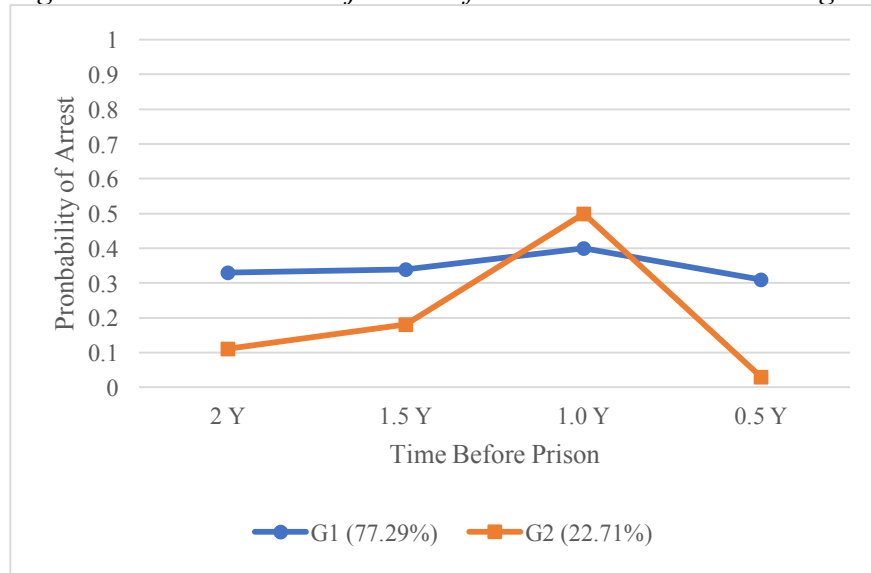
In the post-prison period, a three-group model was selected. The trajectory patterns are displayed in *Figure 16*. Consistent with prior analyses, the three group post-prison model contains a non-recidivating group, a group with a moderate declining probability of recidivism, and a group with a high, roughly stable, probability of recidivism.

*Figure 16. Post-Prison Trajectories for First Time Prisoners- Age 20+*
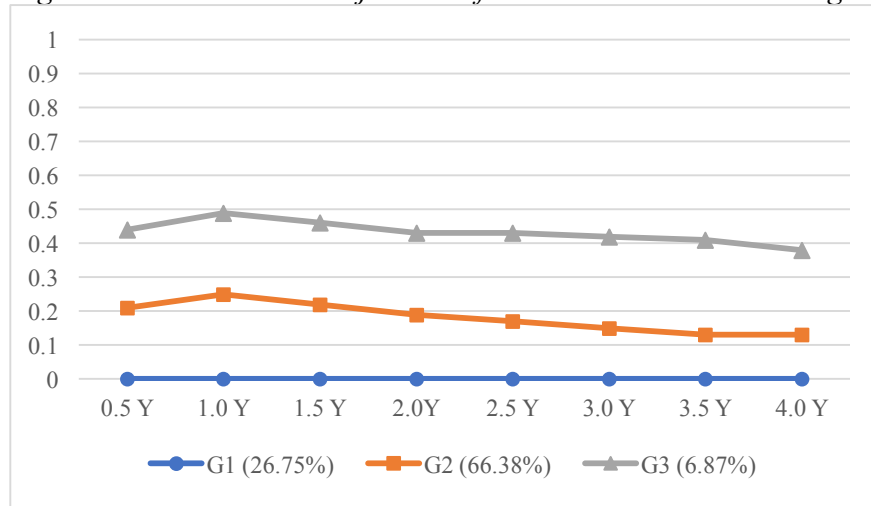
Of the six possible transitions for first-time prisoners, two were deemed consistent with a positive turning point, two indicated a negative turning point, and two did not demonstrate clear evidence of discontinuity. Per this classification, 40.11% of first time prisoners imprisoned at or after age 20 exhibit evidence of a positive turning point, 2.73% exhibit evidence of a negative turning point, and 57.16% do not demonstrate discontinuity in arrest and recidivism. This distribution mirrors that presented for first-time prisoners in Section 6.2.1 and the main analysis in Chapter 4.

6.1.3. Pre- and Post-Prison Trajectories for Repeat Prisoners—Age 21+

Including individuals imprisoned between the ages of 21 and 22 did not markedly change the size of the repeat prisoner sample. In total, only 133 observations were added to original sample of 11,737 repeat prisoners. Including these 133 cases did not change the average age in the sample (in both cases the average age at admission to prison is 36-years old). However, the average probability of arrest in each pre-prison period and recidivism in each post-prison period did slightly increases with the expansion of the sample.

Pre-prison trajectory models were estimated in the three years leading up to imprisonment. A three-group model was selected. *Figure 17* demonstrates that shortening the pre-prison period does change the trajectory solution for repeat prisoners. Some change was to be expected simply by shortening the trajectory period. *Figure 17* compares the pre-prison trajectories in the main analysis and with the shorter follow-up period. The portion of *Figure 17* highlighted in orange indicates the portion of the pre-prison period excluded from the estimation with 21 year olds are added to the sample, thus marking the variation lost by shortening the pre-prison period. This change as consequential because in the main analysis, a large portion of the variation between trajectory groups among repeat prisoners was observed in the fourth year prior to imprisonment, the period which is excluded here. This suggests that the change in trajectory patterns are a function of changing the length of the pre-prison period rather than the sample.

Figure 17. Pre-Prison Trajectory Solutions for Repeat Prisoners in the Main Analytic Sample* and Sample Including Individuals Imprisoned at Age 21.

Pre-Prison Trajectory Solution for Repeat Prisoners- Age 22+	Pre-Prison Trajectory Solution for Repeat Prisoners- Age 21+
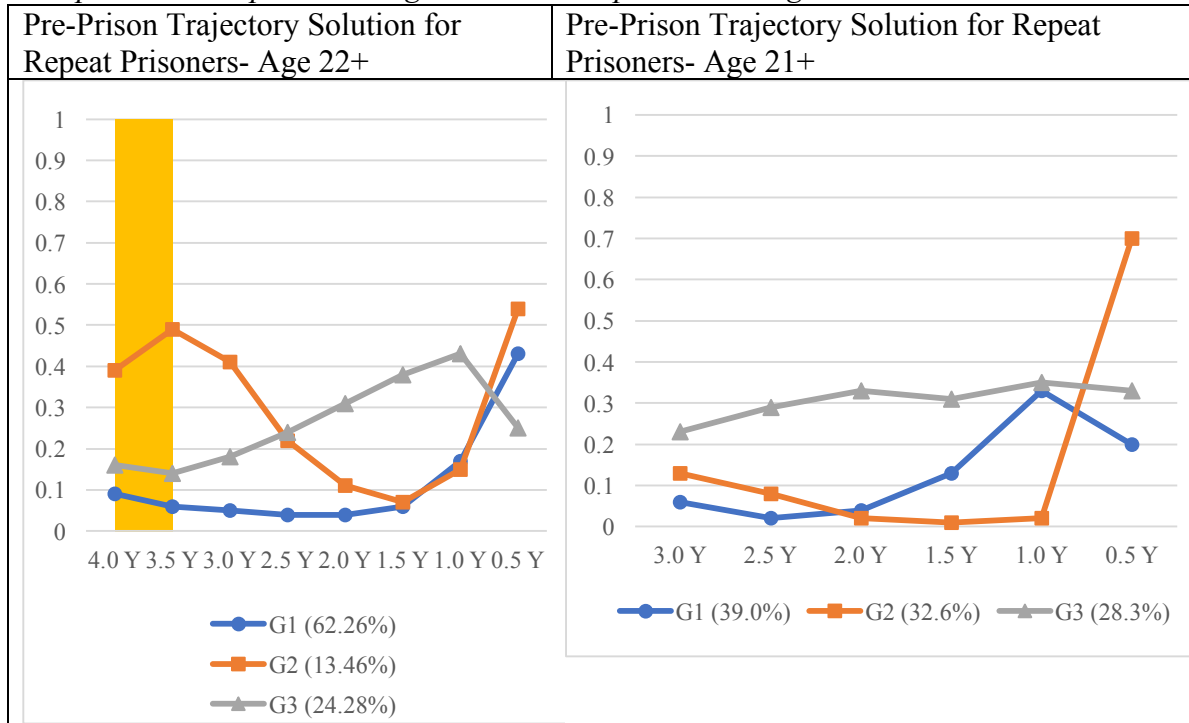
* Highlighted portion of the graph in the left-hand column signifies the portion of the trajectory period that is NOT estimated in the model depicted in the right-panel.

In the post-prison period, a three-group model was selected. Unlike in the pre-prison period, the recidivism trajectories mirror the patterns in the main analysis. *Figure 18* depicts the three-group solution for repeat prisoners imprisoned at or after age 21.

Figure 18. Post-Prison Trajectories for Repeat Prisoners- Age 21+


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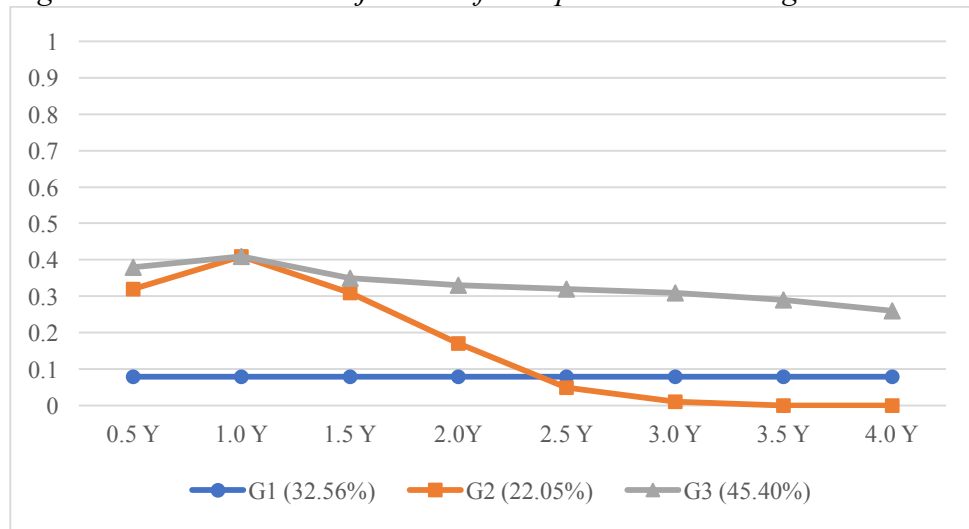
In the repeat prisoner sample, there were nine possible transitions between trajectory groups. Per the criteria set forth in Chapter 4, three transitions were classified as evidence of a positive turning point and two were classified as evidence of a negative turning point. The remaining four transitions did not demonstrate enough discontinuity to infer clear changes in the trajectories. As such, 35.86% of the repeat prisoners sample including individuals imprisoned at age 21 demonstrated evidence of a positive turning point, 29.56% demonstrated evidence of a negative turning point, and 34.58% did not exhibit discontinuity. Compared to first-time prisoners imprisoned at or after age 21, repeat prisoners are more likely to exhibit discontinuity in offending. Additionally, a larger portion of repeat prisoners exhibited evidence of a negative turning point. Both findings are consistent with the main analysis.

6.1.4. Pre- and Post-Prison Trajectories for Repeat Prisoners—Age 20+

Adding individuals returning to prison between the ages of 20 and 22 only increases the sample size by 176 observations (N= 11,913). The average age in the repeat prisoner sample remains 36 years old with this expansion. In both the pre- and post-prison period the inclusion of younger inmates increased the probability of arrest and recidivism, though changes were very small ranging from 0.0001 to 0.0015.

In the pre-prison period, a three-group trajectory solution was selected. *Figure 19* illustrates the trajectory patterns. Consistent with Section 6.1.3 above, shortening the pre-prison alters the trajectory solution for repeat prisoners. Unlike in the main analysis, a high probability declining group did not emerge. Instead, the trajectory patterns more closely resemble the patterns exhibited in the full sample (see below).

Figure 19. Pre-Prison Trajectories for Repeat Prisoners- Age 20+
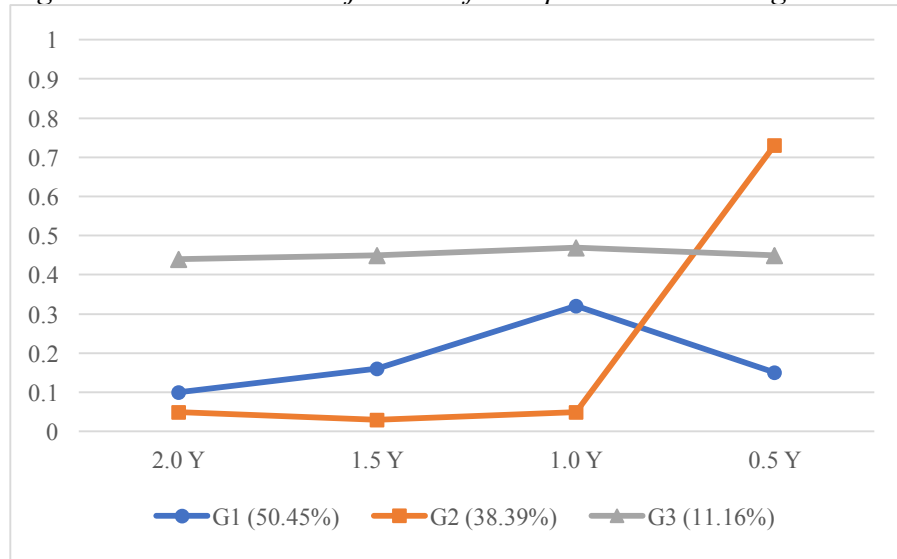
A three-group solution was also selected in the post-prison period. *Figure 20* demonstrates that the trajectory patterns from the main analysis were replicated in the sample including individuals returning to prison at or after age 20. The proportion of observations in each group is also comparable.

Figure 20. Post-Prison Trajectories for Repeat Prisoners- Age 20+
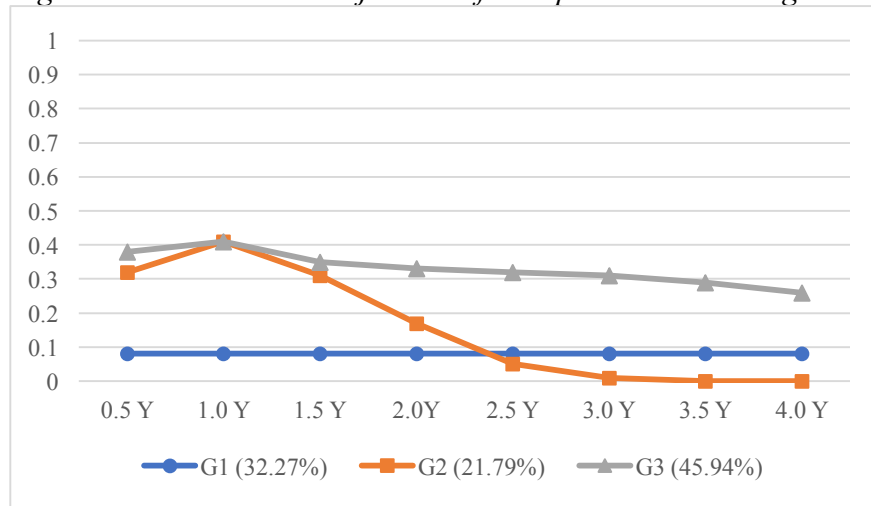
Of the nine possible transitions between trajectory groups, three were classified as positive turning points, two were deemed negative turning points, and four demonstrated little evidence of discontinuity. Accordingly, 35.77% exhibit evidence of a positive

turning point and 16% exhibit evidence of a negative turning point. In this iteration of the dual trajectory analysis, 48% of repeat prisoners exhibit no evidence of a turning point. The proportion of repeat prisoners exhibiting no turning point is higher than in prior analyses wherein only 34.5% and 24% of repeat prisoners displayed trajectory transitions inconsistent with any turning points. The variation is due to membership in the pre-prison trajectory group and transitions from those groups. Despite this change, most repeat prisoners exhibit evidence of a turning point, and compared to first-time prisoners, a substantially larger portion of repeaters exhibit patterns of arrest and recidivism that are consistent with a negative turning point. It can therefore be concluded that this sensitivity analysis replicated the findings in Chapter 4.

6.1.5. Summary: Sensitivity Analysis 1

Overall, repeat prisoners are more likely than first time prisoners to exhibit evidence of any turning point. Repeat prisoners were more likely to exhibit evidence of a negative turning point than first time prisoners. This pattern is consistent with the results presented in the main analysis, and lend support to Hypothesis 2A. A slightly larger portion of first time prisoners exhibited evidence of a positive turning point, but still the majority of first time prisoners did not demonstrate evidence of discontinuity in arrest and recidivism trajectories, contradicting Hypothesis 2B.

**6.2. Sensitivity Analysis 2: Estimating Pre- and Post-Prison Trajectories in the Full Sample**

6.2.1. Pre- and Post-Prison Trajectories in Full Sample—Age 21+

Incorporating individuals imprisoned at or after age 21 increased sample size by 1,267, resulting in a final sample of 26,159. The average age at admission to prison slightly decreased from 34.63 (SD=9.28 years) to 33.99 years (SD=9.48) with the

inclusion of this group. There was also very little change in the average probability of arrest or recidivism. When 21-year olds are added to the sample, the pre-prison probability of arrest increased by between 0.0068 and 0.0084, except in the six months immediately preceding imprisonment when the probability of arrest declined by 0.0014. In the post-prison period the average probability of uniformly recidivism increased, although the change was very slight (ranging from a 0.0012 to 0.0029).

As in the main analysis, the pre-prison trajectories in the full sample converged with up to four trajectory groups. A three-group model with all cubic groups, depicted in *Figure 21*, was selected. This solution contains one low activity group comprising just over quarter of the sample, a low increasing group comprising 13% of the sample, and a moderate (relatively) stable group comprising almost 60% of the sample. The trajectory patterns and group sizes are consistent to those presented in Chapter 4.

Figure 21. Pre-Prison Trajectory Solution in Full Sample—Age 21+
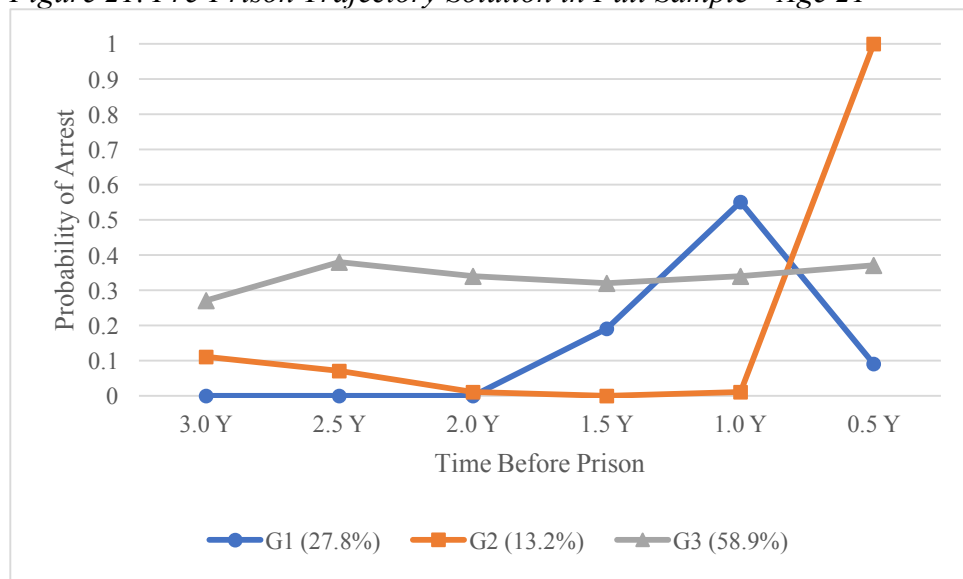
In the post-prison period, the trajectory models converged up to eight groups. A three-group solution was selected. The three-group solution contains one stable non-recidivating group (19.8%), one moderate probability declining group (68.6%), and one

high probability declining group (11.7%). Again, this solution mirrors the solution in the main analysis.

Figure 22. Post-Prison Trajectory Solution in Full Sample—Age 21+
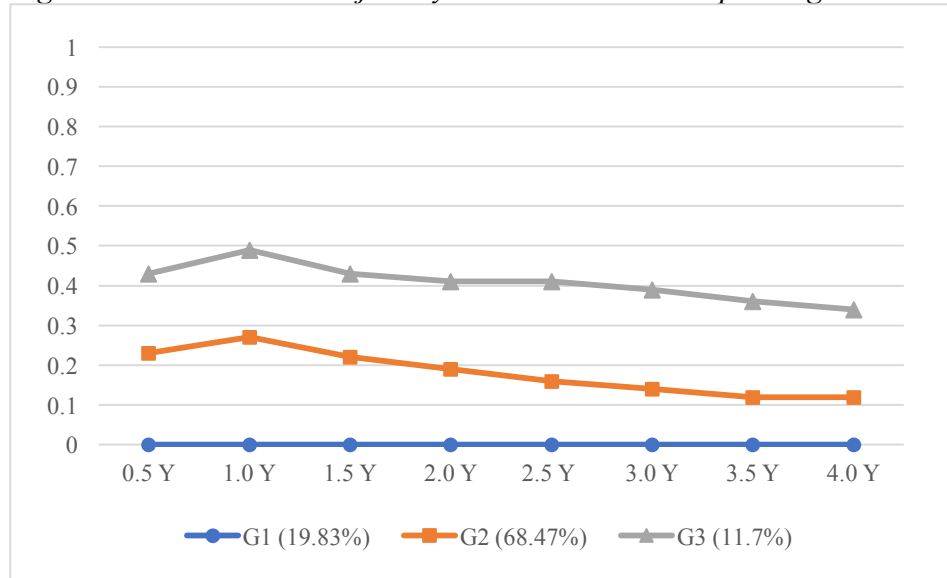
With three pre- and post-prison trajectory groups, there were nine possible transitions in the full sample. Because the trajectory patterns looked so similar to those in the main analysis, transitions were classified in the same way as described in Chapter 4. Of the nine possible transitions, three demonstrated evidence of discontinuity consistent with a positive turning point, four demonstrated evidence of discontinuity associated with a negative turning point, and two demonstrated no evidence of discontinuity. Per this classification scheme, 33.48% of the sample exhibited discontinuity associated with a positive turning point, 16.56% of the sample exhibited discontinuity consistent with a negative turning point, and 49.97% of the sample exhibited no clear evidence of any turning point. Thus, distribution mirrors the main analysis wherein 33.85% of the sample exhibits evidence of a positive turning point, 15.1% experiences discontinuity associated with a negative turning point, and 50.97% exhibits no evidence of a turning point, respectively.

The results of the post-trajectory multinomial logistic regressions are reported in *Tables 48 and 49 Table 48* reports the regression estimates weighted by the posterior probabilities of group membership in both the pre- and post-prison trajectory period, and *Table 49* displays the results with bootstrapped standard errors, estimated with 500 repetitions. In each model, the dependent variable was a categorical measure grouping transitions classified as positive, negative, and non-turning points. Each model also contains all covariates reported in Chapter 4, but I only report the coefficients for age and prior imprisonments here.

Table 48. Weighted Multinomial Logistic Regression Results for Full Sample, Including Individuals Imprisoned at Age 21

	Positive TP vs. No TP		Negative TP vs. No TP		Positive TP vs. Negative TP	
Variable	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age at Admission	1.0302**	0.0018	0.9943*	0.0024	1.0361**	0.0026
Prior Imprisonments	0.8211**	0.0167	1.1738**	0.0147	0.6995**	0.0192

** p<0.01, *p<0.05

Table 49. Multinomial Logistic Regression Results for Full Sample with Bootstrapped Standard Errors—Age 21+

	A) Positive TP vs. No TP		B) Negative TP vs. No TP		C) Positive TP vs. Negative TP	
Variable	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age at Admission	1.0309**	0.0019	0.9942*	0.0025	1.0370**	0.0024
Prior Imprisonments	0.8220**	0.0161	1.1739**	0.0152	0.7003**	0.0203

** p<0.01, *p<0.05

Focusing first on prior imprisonments, the odds of observing a discontinuity consistent with a positive turning point, relative to a non-turning point or a negative turning point, significantly decrease as prior imprisonments increase (Panels A and C). Furthermore, the odds of observing a negative turning point relative to no turning point

increase by 17% with each prior imprisonment. Collectively, these results suggest that prior imprisonments are associated with offending amplification, supporting hypothesis 2A.

With respect to the timing of imprisonment, Panel A in *Tables 48* and *49* reveals that the odds of observing behavioral change consistent with a positive turning point relative to no turning point increase as age at imprisonment increases. Additionally, as age of imprisonment increases, the odds of exhibiting discontinuity in offending consistent with a positive turning point increases relative to a negative turning point. The odds ratios for the age variable in Panel B of *Tables 48* and *49* reveals a negative relationship, meaning that as individuals are imprisoned later in the life course, the odds of observing a negative turning point relative to no turning point decrease. A negative relationship was found in the main analysis, but was not significant. Binary measures of age, capturing imprisonment between ages 21 and 25 (emerging adulthood) confirm that younger individuals are less likely to experience a positive turning point relative to no turning point. However, imprisonment during emerging adulthood was not significantly related to the odds of observing a negative turning point. This suggests that the negative relationship between age at admission to prison and the odds of observing a negative turning point is restricted to individuals imprisoned after age 25.

6.2.3. Pre- and Post-Prison Trajectories in Full Sample—Age 20+

Adding individuals imprisoned at or after age 20 to the sample increased the sample size from 24,892 to 27,878. (2,395 observations). With this expansion, the average age at admission to prison decreases from 34.63 years (SD= 9.28) to 33.44 (SD=

9.68).   The probabilities of arrest in the pre-prison and recidivism in the post-prison period slightly increased in all periods with the addition of younger individuals.

The pre-prison trajectories were estimated in the two years prior to imprisonment, resulting in four trajectory periods. The trajectory models converged up to four groups, though classification error was substantially higher than in prior models with the full sample. A three-group model was selected. This solution is depicted in *Figure 23* below. Both the patterns and group sizes are consistent with the main analysis and 21-year-old sample reported in section 6.2.1.

Figure 23. Pre-Prison Trajectories in Full Sample—Age 20+
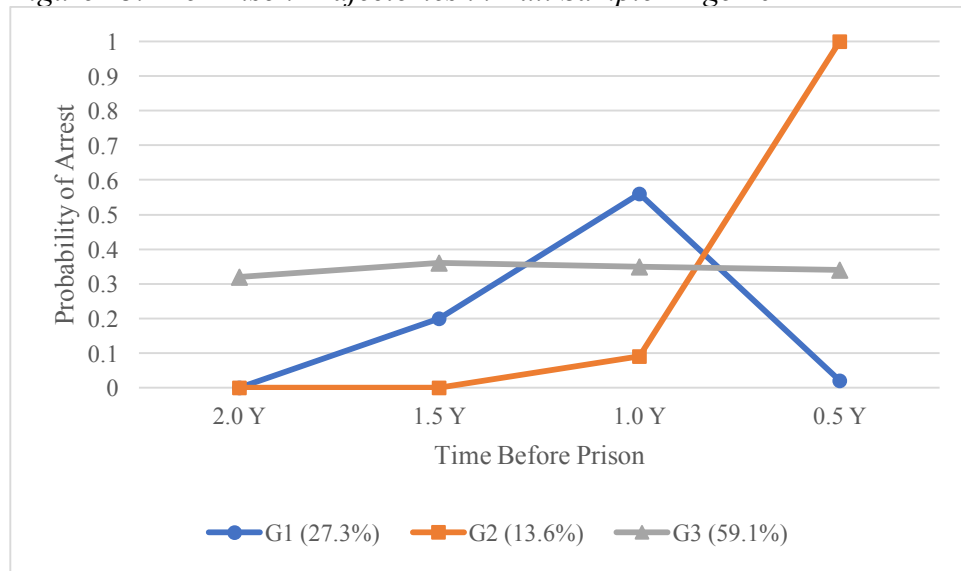
Recidivism trajectories were estimated in the four years following release from prison. A three-group solution, comprised of a non-offending group (19.41%), a moderate declining group (68.6%), and a high, slightly declining group (12%), was selected. Recidivism trajectories are displayed in *Figure 24*. Again, the patterns and group sizes are consistent with prior analyses using the full sample.

Figure 24. Post-Prison Trajectories in Full Sample—Age 20+
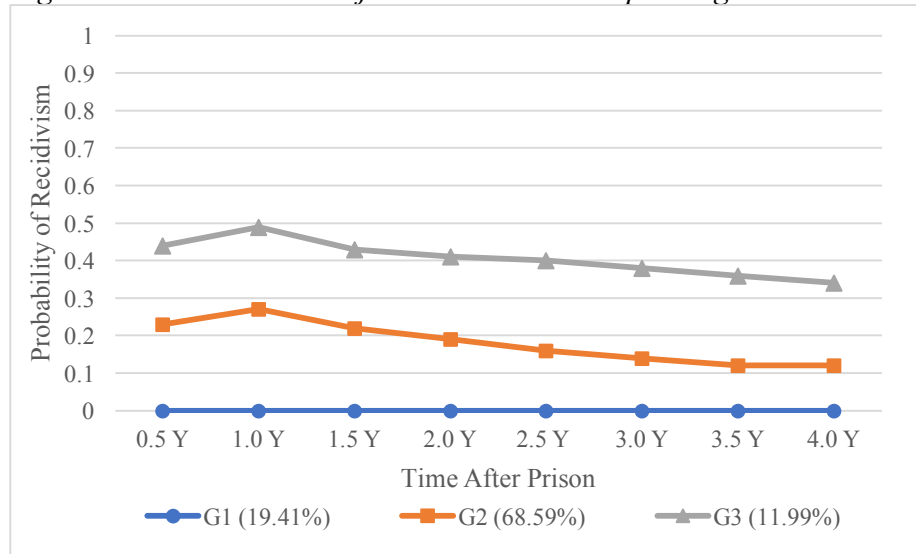
With three pre-and post-prison trajectory groups, there were nine possible transitions that may indicate discontinuity in offending consistent with a turning point. Three transitions were classified as indicating a positive turning point, four as indicating a negative turning point, and two did not demonstrate evidence of any turning point. Thus, 33.07% of the sample exhibited evidence of a positive turning point, 20.11% exhibited evidence of a negative turning point, and 48.82% exhibit evidence of no turning point. Compared to the main analysis, this distribution is relatively consistent, although an additional 5% of the sample is classified as exhibiting a negative turning point.

Post-estimation regression analyses predicting positive and negative turning points are reported in *Tables 50 and 51*. Consistent with prior analyses, prior prison terms increase the odds of observing discontinuity reflecting a negative turning point relative to observing no turning point or evidence of positive turning point. Prior prison terms also decrease the odds of observing a positive turning point, relative to no turning point.

Table 50. Weighted Multinomial Logistic Regression Results for Full Sample—Age 20+

	Positive TP vs. No TP		Negative TP vs. No TP		Positive TP vs. Negative TP	
Variable	OR	Robust SE	OR	Robust SE	OR	Robust SE
Age at Admission	1.0324**	0.0018	1.0009	0.0022	1.0314**	0.0023
Prior Imprisonments	0.7828**	0.0166	1.0535**	0.0159	0.8247**	0.0198

** p<0.01, *p<0.05

Table 51. Multinomial Logistic Regression Results for Full Sample with Bootstrapped Standard Errors—Age 20+

	Positive TP vs. No TP		Negative TP vs. No TP		Positive TP vs. Negative TP	
Variable	OR	Bootstrap SE	OR	Bootstrap SE	OR	Bootstrap SE
Age at Admission	1.0326**	0.0017	0.9998	0.0020	1.0328**	0.0025
Prior Imprisonments	0.7782**	0.0175	1.0612**	0.0156	0.8259**	0.0188

** p<0.01, *p<0.05

With respect to timing, older age at admission to prison increases the odds of observing a positive turning point relative to no turning point and negative turning points, suggesting that older individuals are most likely to exhibit positive turning points. Employing a binary measure of age capturing imprisonment between the ages of 20 and 25 confirms this pattern. In this sample, age at admission to prison is not significantly related to the odds of observing a negative turning point.

6.2.5. Summary: Sensitivity Analysis 2

Overall, the second sensitivity analysis suggests that the results reported in the main analysis are robust to changes in sample age and the length of the pre-prison period. Adding individuals imprisoned between the ages of 20 and 22, thereby decreasing the pre-prison trajectory periods by one and two years, did not greatly alter the trajectory patterns that emerge, or the relative distribution of the sample the exhibits evidence of positive, negative, or no turning points.

Multinomial logistic regressions performed on the 21+ and 20+ year old samples largely replicated the findings in the main analysis. In all three samples, prior prison terms increased the odds of observing a negative turning point, and decreased the odds of observing a positive turning point relative to no turning points. Prior prison terms also decreased the odds of observing a positive turning point relative to a negative turning point. Taken together, these results suggest that individuals with more prior prison terms are most likely to exhibit behavioral change consistent with a negative turning point, and least likely to exhibit behavioral change consistent with a positive turning point. This finding is robust to changes in sample age and the length of the pre-prison trajectory period, and support hypothesis 2A.

Older age at admission to prison significantly increased the odds of observing a discontinuity in offending consistent with a positive turning point relative to no turning point or evidence of a negative turning point. It is clear that across all analyses, older age at admission to prison is increased the odds of observing a discontinuity in arrest and recidivism consistent with a positive turning point. The relationship between age and negative turning points was slightly less stable. Age at admission decreased the odds of observing a negative turning point relative to no turning point in the analysis incorporating 21 year olds, but was not significant when individuals imprisoned at age 20 were included or in the main analysis. Although the odds of observing a positive turning point relative to a negative turning point increased with age at admission to prison (suggesting that negative turning points are more likely than positive turning points for younger inmates), there was no evidence that imprisonment during emerging adulthood

increased the odds of observing a negative turning point in the full sample. As such, evidence for hypothesis 3 is mixed.

6.3. Sensitivity Analysis 3: Post-Estimation Regressions in First-Time and Repeat Prisoner Samples

Hypothesis 4 states that first-time imprisonment is more likely to result of offending amplification (or a negative turning point) if individuals are imprisoned earlier in the life course, particularly if it occurs during emerging adulthood. To test this hypothesis and allow for the possibility the relationship of repeat imprisonment and offending may also vary with age, post-estimation multinomial logistic regressions used age at admission to prison as a predictor of positive and negative turning points, in the first-time and repeat prisoner samples separately. Separate regressions were estimated to incorporate weights and bootstrapped standard errors.

In both the first-time and repeat prisoner sample, older age at admission to prison increased the odds of observing a positive turning point, relative to both experiencing a negative turning point and no turning point. It appears that imprisonment later in the life course, first time and otherwise, is more likely to result in offending change consistent with a positive turning point than any other outcome (i.e., a negative turning point or no turning point). This pattern is confirmed when a categorical measure of age is used; individuals imprisoned between the ages of 21 and 25, or 20 and 25 are more likely to exhibit no turning point than a positive turning point.

The relationship between age at admission to prison and negative turning points is less clear. A continuous measure of age was consistently associated with lower odds of observing a negative turning point relative to no turning point among first time and repeat prisoner, suggesting that negative turning points are more common than no turning points

with young age at admission to prison, but the binary measure of age suggests that imprisonment between the ages of 20 and 25 is unrelated to negative turning points. Though it appears younger inmates are more likely to exhibit negative turning points, this pattern may be limited to inmates imprisoned after age 25.

Appendix B: Accounting for Exposure Time

When estimating arrest and recidivism patterns, it is important to consider the amount of time each person spends on the street at risk of being arrested or recidivating. If an individual is incarcerated, the probability of arrest or recidivism drops to zero. Consider two individuals who exhibit no arrests in the year prior to prison, one who was not incarcerated during the year and the other who was incarcerated for 11 of the 12 months. The trajectories for these individuals would look identical, even though one individuals exhibited zero arrests while in the community, and the other exhibited no arrests because he/she was incapacitated. Distinguishing periods of non-arrest due to incapacitation or abstinence from crime is important for accurately understanding how and why offending changes.

Differential exposure, or time on the street, is a particularly problematic for estimating criminal trajectories of prisoners, many of whom are on parole supervision while in the community. Parole supervision increases the likelihood that authorities detect recidivism and provides the state with an easier avenue to quickly incarcerate or detain an individual compared to if he or she was not on parole supervision. Those under correctional control are more likely to be incapacitated, so, a positive turning points could be falsely inferred from a trajectory that demonstrates decline or no offending, when a parolee is simply off the street. For this reason, I calculated a time varying measure of exposure, capturing the proportion of time on the street in each trajectory period. This exposure variable was estimated as a time varying covariate in the trajectory model, allowing the shape and intercept of the trajectory group to vary as a function of time on the street. This adjustment avoids bias in estimating the criminal trajectories (Nagin,

2005), and by extension, would avoid bias in classifying certain transitions as positive or negative turning points without correction for incapacitation. However, as this chapter will demonstrate, incorporating the time varying covariate into the trajectory model introduced more problems than it solved. Below, I descriptively review time on the street for this sample, and provide an example of the challenges faced when introducing this measure into the trajectory estimation.

7.1 Descriptive Assessment of Exposure

To capture exposure time, or time on the street, the dates of every admission or release from a Pennsylvania (PA) state prison occurring in the four-year pre- and post-prison time periods were provided by the Department of Corrections. Using these dates, I determined if an individual was incarcerated and/or released in each pre- and post-prison interval, and by extension, determined the number of days spent incarcerated in state prison and the number of days spent on the street. The number on the street was divided by the total number of days in the trajectory period, resulting a measure that captures the proportion of time spent in the community for each of the eight pre- and post-prison trajectory periods. This variable ranges from zero to one, with zero representing imprisonment during the entire six-month period (no exposure) and one indicating that the subject was not incarcerated in a state prison at any point during the six-month time-period (full exposure). To be clear, this measure of exposure time only accounts for time spent incarcerated in a PA state prison. Time spent in any jail, any prison in another state, in a parole violator center, in the hospital, or any other residential facility is not included because data on these experiences were not available. As such, this exposure measure is only a crude representation of time on the street which likely overstates time on the street.

The average proportion of each pre-prison period spent on the street (not in state prison) in the full and repeat prisoner samples are depicted in Table 52. First time prisoners are not included in this table because by definition, they are not imprisoned during this time. On average, in the full sample between 3-15% of any pre-prison trajectory period was spent in a PA state prison. For repeat prisoners, exposure time is lower; between 5-30% each pre-prison period was spent imprisoned.

Table 52. Average Pre-Prison Exposure Time in Each Trajectory Period for the Full and Repeat Prisoner Samples

Pre-Prison Trajectory Period	Average Exposure Time– Full Sample	Average Exposure Time – Repeat Prisoners
3.5 to 4.0 Years Before Prison	0.8592	0.7050
3.0 to 3.5 Years Before Prison	0.8575	0.7013
2.5 to 3.0 Years Before Prison	0.8536	0.6930
2.0 to 2.5 Years Before Prison	0.8535	0.6926
1.5 to 2.0 Years Before Prison	0.8616	0.7091
1.0 to 1.5 Years Before Prison	0.8832	0.7545
0.5 to 1.0 Years Before Prison	0.9235	0.8393
0.0-to 0.5 Years Before Prison	0.9731	0.9437

Reviewing the distribution of pre-prison exposure time revealed that 6,112 individuals spent at least one day in a state prison prior to the focal imprisonment. Because first-time prisoners by definition are not imprisoned during this time, all of these individuals are repeat prisoners. This amounts to 21% of the full sample and 52% of the repeat prisoner sample. Of the individuals imprisoned in at least one pre-prison period, the distribution is also skewed; 75% spend time in prison in fewer than 3 pre-prison periods.

Figure 25. Histogram of Exposure Time in the Pre-Prison Period for the Full and Repeat Prisoner Samples

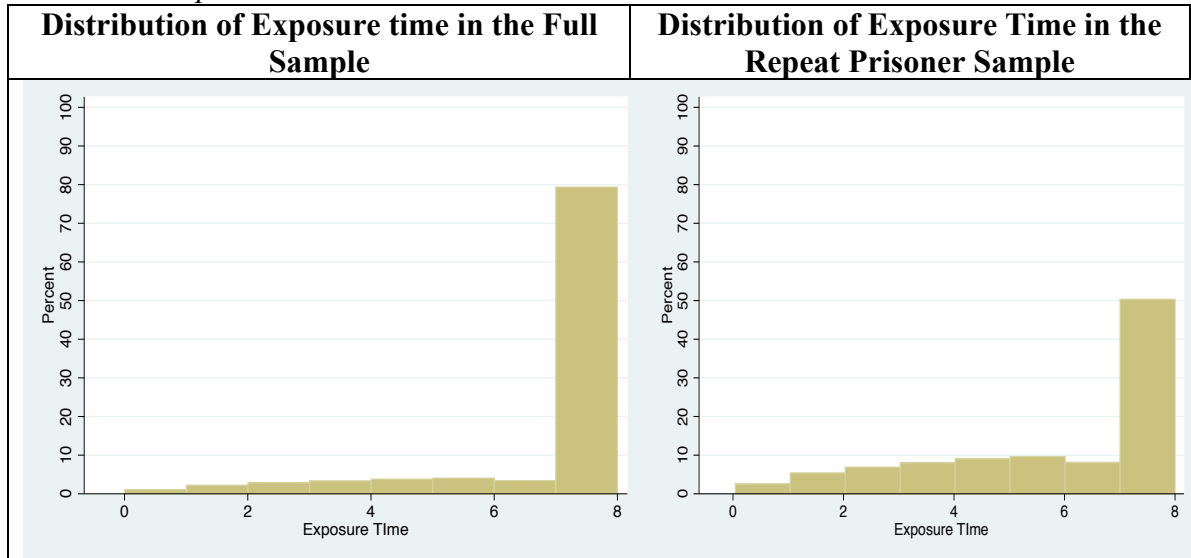| Distribution of Exposure time in the Full Sample	Distribution of Exposure Time in the Repeat Prisoner Sample

Figure 25 contains the histograms of pre-prison exposure time for the full sample and repeat prisoner sample. The x-axis in the figure represents the total exposure time across the four-year pre-prison period, calculated as the sum of the ratios of time on the street in each pre-prison period. A value of 8 indicates no days incarcerated during the four years prior to the focal imprisonment. A value of 4 indicates exactly 50% of the pre-prison period was spent on the street, and a value of 0 indicates incarceration every day during the four-year period. The left skews in *Figure 25* indicates that a fairly small portion of the pre-prison period is spent incarcerated. Of the individuals who are incarcerated at some point in the pre-prison period, the distribution of exposure is roughly uniform (*See Figure 26*).

Figure 26. Exposure Time for Repeat Prisoners Who Spend at least 1 Day Imprisoned in the Four Years Prior to the Focal Imprisonment
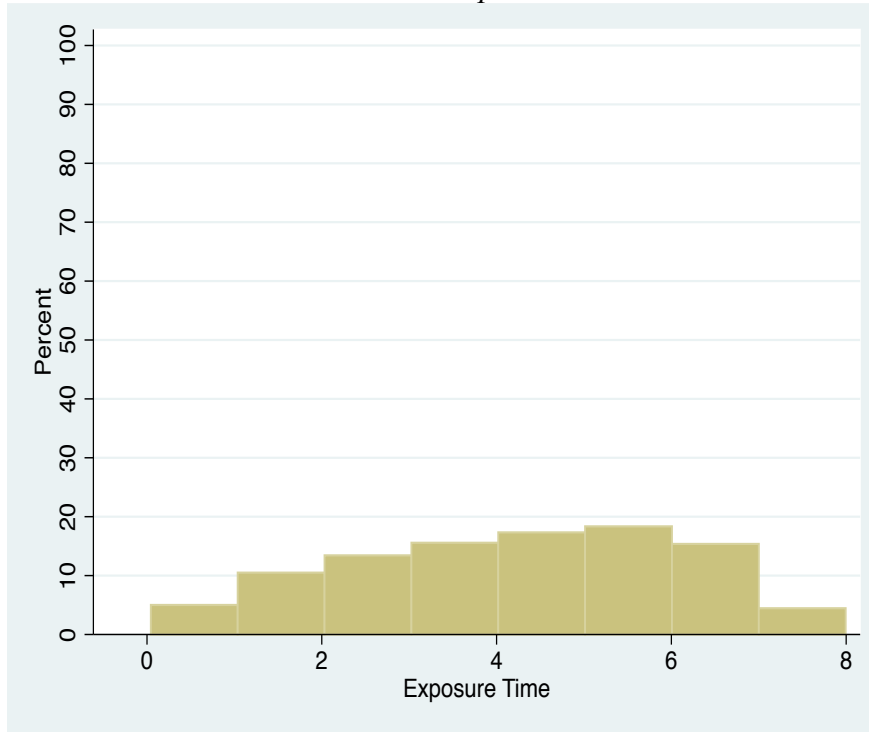
Exposure time is also a concern in the post-prison period, because all individuals in the sample are released from prison onto parole supervision. *Table 53* contains the average proportion of each post-prison period that was spent incarcerated, disaggregated by analytic sample. Across, the board, less than 25% of each post-prison period was spent re-incarcerated in a PA state prison, regardless of the sample.

Table 53. Post-Prison Exposure Time, Disaggregated by Analytic Sample

Years after Prison	Average Exposure Time- Full Sample	Average Exposure Time- Repeat Prisoners	Average Exposure Time- First Time Prisoners
0.0 to 0.5 Yrs	0.94026	0.9225	0.9561
0.5 to 1.0 Yrs	0.8454	0.8079	0.8790
1.0 to 1.5 Yrs	0.7966	0.7549	0.8339
1.5 to 2.0 Yrs	0.7884	0.7480	0.8244
2.0 to 2.5 Yrs	0.7968	0.7576	0.8318
2.5 to 3.0 Yrs	0.8044	0.7680	0.8369
3.0 to 3.5 Yrs	0.8168	0.7824	0.8474
3.5 to 4.0 Yrs	0.8260	0.7950	0.8536

In the post-prison period, 47% of the full sample spends at least one day in a PA state prison. This means that 53% of the sample is fully exposed during the post-prison period. In the first-time prisoner and repeat prisoner samples, 40% and 55% of inmates spend at least one day incarcerated in state prison, respectively. As in the pre-prison period, the distributions of exposure are highly skewed to the left. Very few individuals were incarcerated for more a full year in four post-prison period (4.2% in the full sample, 3.2% of first-time prisoners, and 5.9% of repeat prisoners). The distribution of exposure time in the post-prison period mirrors that in the pre-prison period, characterized by the left skew in all analytic samples.

The bivariate relationship between exposure time and the probability of arrest and recidivism is positive in every trajectory period. Logistic regressions predicting the probability of arrest or recidivism in each trajectory period with the exposure variable in the same period revealed that the odds of observing an arrest or recidivism event increased as time in the street increases, which is intuitive. Additionally, there are no instances in which an individual is arrest in a period where exposure is zero. Together, these patterns indicate that the exposure variable appropriately captures time on the street, and can be incorporated into the trajectory model.

7.2 Including Exposure in the Trajectory Models

There are two ways to incorporate exposure time into trajectory models directly. In the first case, the expose in Stata option adjusts outcomes to account for the value of another variable (e.g. time on the street). This option can only be used with the zero-inflated Poisson trajectory specification, and therefore is not relevant here (Jones & Nagin, 2012). The other option to account for potential incapacitation is to include a

time-varying measure of exposure as a covariate in the estimation of the pre- and/or post-prison trajectories. Specifically, in addition to modeling the probability of arrest or recidivism in each of the six months' trajectory periods, the variable capturing the proportion of time an individual was incarcerated in each of the six-month intervals is controlled for. The original GBTM formula extends to include time varying covariates in the model's estimation:

$$Recidivism_{it}^{j} = \frac{e^{\beta_0^j + \beta_1^j Time_{it} + \beta_2^j Time^2_{it} + \beta_3^j Time^3_{it} + \alpha^j exposure_{it}}}{1 + e^{\beta_0^j + \beta_1^j Time_{it} + \beta_2^j Time^2_{it} + \beta_3^j Time^3_{it} + \alpha^j exposure_{it}}}$$

where *exposure$_{it}$* is the proportion of time individual *i* is incarcerated during interval *t*, and α^j is the group specific coefficient representing the relationship between exposure and recidivism (or pre-prison arrests). Adding a time varying covariate to the trajectory model is similar to adding a control variable in a regression; the trajectory pattern is estimated holding constant the variation in exposure time (Nagin, 2005).

In all cases, including the time varying measure of exposure increased classification error and presented convergence issues. Whereas the pre-prison trajectories previously converged with up to four or five groups, including exposure reduced the number of groups that could be estimated to two or three. The same was true in the post-prison period. Including exposure time reduced then number of groups that the dual trajectory model could estimate, from seven or eight, to four or five. As an illustrative example, consider the repeat prisoner sample. I chose this sample because there is descriptive evidence that exposure determines the trajectory patterns in both the pre- and post-prison periods. In the main analysis without exposure, the pre-prison models converge up to 5 groups, whereas with the time varying covariate the models only converged up to three groups. Failed convergence in models that previous converged

raises concern about the use of the exposure variable as a time-varying covariate because there is evidence that a fourth and fifth group can be estimated with a more parsimonious parameterization.

Table 54. Fit Statistics for Three-Group Pre-Prison Trajectory Solutions for Repeat Prisoners, with and without the Exposure Covariate

	Pre-Prison Main Analysis	**Pre-Prison Model with Exposure**
BIC	-41045.20	-39126.12
AvePP$_j$ (%)		
Group 1	0.780 (62.26%)	0.486 (27.73%)
Group 2	0.727 (13.47%)	0.542(28.13%)
Group 3	0.687 (24.28%)	0.665 (44.14%)
OCC$_j$		
Group 1	2.144	2.464
Group 2	17.103	3.023
Group 3	6.783	2.512

Table 54 contains the fit statistics for the three-group pre-prison trajectory solution selected in the repeat prisoners sample in the main analysis and the same model including exposure as a time varying covariate. Without the exposure variable, model fit is good. AvePP values very close to or above the recommended threshold and large OCC values suggests sufficient classification accuracy. On one group with an OCC value that falls below the recommended threshold of 5.0, the AvePP reveals sufficiently high posterior probabilities of group membership. By contrast, when the exposure variable is added as a time varying covariate, classification error greatly increases. The AvePP values fall well below the recommended standards. In one group the AvePP falls below 0.5, meaning that there is more than 50% chance of classification error in this group. The OCC values tell a similar story, in that none of the values approach the 5.0 threshold. These fit statistics are concerning, indicating high levels of classification error. The consequences of this error are discussed below.

Figures 27 and 28 contain the trajectory solution for each three-group model. Figure 27 is reproduced from Chapter 4 and Figure 28 contains the trajectories with the time varying measure of exposure added. Two things stand out when comparing these two figures. The first is that the predicted probability of arrest is lower when accounting for exposure time. This suggests that without exposure, the probability of arrest may be overstated. Second, the trajectory patterns become very spiky when exposure time was included. Bushway and colleagues (2009) note that group based trajectory models do a poor job handling this kind of variation, and model fit improves when change in the outcome is more gradual. Fluctuation in the probability of arrest in consecutive time periods may account for the poorer fit of the three-group solution when the time varying measure of exposure was included.

Figure 27: Three Group Pre-Prison Trajectory Solution for Repeat Prisoners without Exposure
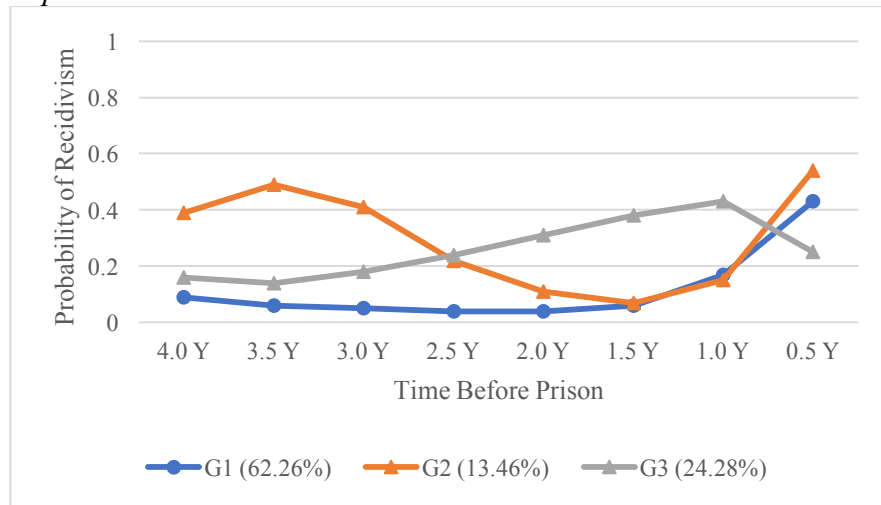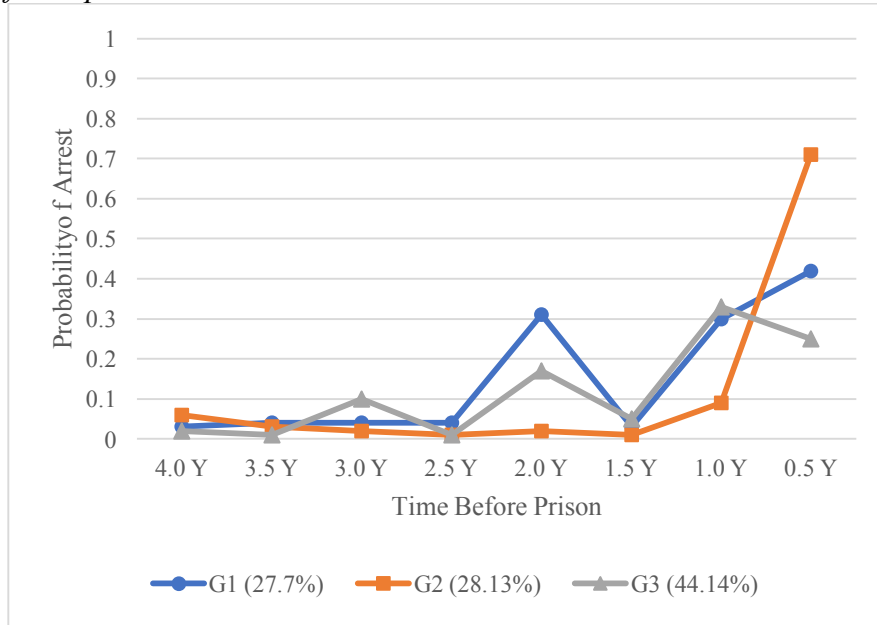
Figure 28. Three-Group Pre-Prison Trajectory Solutoin for Repeat Prisoners Accounting for Exposure Time

The trajectory graphs produced by Stata 14 are presented in *Figures 29 and 30*. I include these figures because they contain not only the estimated probability of arrest in each interval (indicated by the line), but also the group average probability of arrest (represented by the colored dots). In *Figure 29*, the estimated probability of arrest generated form the trajectory model without exposure coincides with the group average, marking appropriate fit. By contrast, the *Figure 30* demonstrates a clear divergence in the predicted probability of arrest and the group average probability of arrest when the exposure variable is added. These inconsistences demonstrate an inferior model and raise questions about the ability of the trajectory model with the time varying covariate to accurately represent the data or capture change in the probability of arrest. Although the average probability of arrest may be biased as it does not account for exposure time, if individuals are appropriately classified into trajectory groups accounting for exposure, the model should at least approximate the average group trends.

Figure 29. Three Group Pre-Prison Trajectory Solution for Repeat Prisoners (Stata Generated Graph)
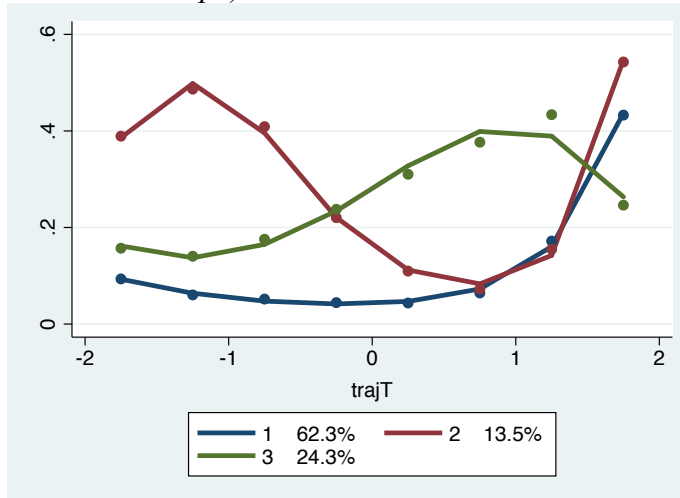

Figure 30.   Three Group Pre-Prison Trajectory Solution for Repeat Prisoners Accounting for Exposure Time (Stata Generated Graph)
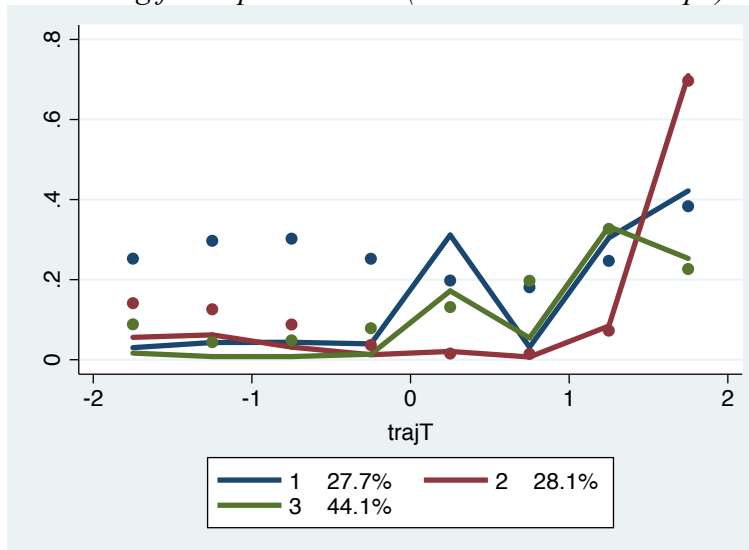
This example represents the challenges faced incorporating exposure time into the pre- and post-prison trajectory models in all samples. Because this research seeks to investigate the extent to which imprisonment serves as a turning point with a dual trajectory model, selecting trajectory solutions that accurately represent the data is a principal concern. Higher levels of classification error mean that there is a greater chance that observations are assigned to the wrong trajectory group, meaning their arrest or

recidivism patterns resemble that of another trajectory group. This is problematic, because sorting individuals into pre- and post-prison trajectory groups is the first of many steps in this analysis, and subsequent analyses rely on those classifications. If I am not reasonably confident that observations are appropriately classified, then I cannot be sure that the data suggests they exhibit evidence of a particular transition. Comparing the proportion of the first-time and repeat prisoner samples was the primary analysis of Section 2 in Chapter 4, which descriptively assessed cumulative disadvantage or repeated exposure to imprisonment. If individuals are sorted into the wrong pre- or post-prison groups, then the estimates of the proportion of each sample exhibiting each transition (or type of turning point) may not be accurate. If group membership is uncertain, then the results of the multinomial logistic regression presented in Sections 3 and 4 of Chapter 4 could also be biased. The multinomial regressions rely on the transitions between trajectory groups, so if individuals are misclassified, then the relationships reflected in the regression would also be wrong. This means that the relationship between prior imprisonments, age at admission to prison, and the odds of observing discontinuities consistent with turning points are uncertain, weakening the validity of the conclusions that can be drawn from this dissertation.

Although it is theoretically important to account for exposure time, doing so in the trajectory model itself was compromised model fit, and specifically classification accuracy, to an unacceptable extent. Without accounting for exposure time, the trajectory models already demonstrated evidence of classification error. Because all analyses in this dissertation rely on the pre- and post-prison trajectory group classification, any increase in classification error must be carefully scrutinized because consequences of

classification error pose a threat to the validity of all subsequent findings. It is my view that the benefits of including exposure do not outweigh the consequences of higher classification error, particularly because this study can employ only a crude measure of exposure, which contains measurement error and overstates time spent on the street. For these reasons, I decided to remove the exposure covariate form the trajectory models. By making this choice, the trajectories in the main analysis cannot be interpreted as reflecting only the probability of arrest or recidivism, but instead represent a composite of arrest/recidivism *and* time spent incarcerated.

To be clear, estimating the dual trajectory models without the exposure variable does not mean that exposure was ignored entirely. In describing the pre- and post-prison trajectory groups, the average proportion of time spent on the street was investigated. When classifying transitions between trajectory groups as exhibiting discontinuity in offending, I considered the extent to which the trajectory pattern observed could be a function of time spent on the street. For example, when the group average exposure time suggested that a low or declining probability of arrest or recidivism could be attributed to incapacitation, the transition was not classified as a turning point. On the other hand, each post-prison trajectory solution contained one group that exhibited a low, stable probability of recidivism despite almost 100% of each post-prison period on the street. This suggests abstinence from offending post-prison, consistent with a positive turning point. Conservative determinations were made such that when there was indication time on the street may drive the trajectory pattern, transitions were not considered turning points. With higher classification accuracy and a consideration of exposure time in the classification of transitions as turning points, the main analysis provides a stronger, more

valid assessment of imprisonment as a turning point than could have been produced by analytically controlling for time on the street.

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