Predictive Patterns of Sex Offenders

Crime Trajectory Analysis Prior to the First Sex Offence

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Abstract

The main aim of the present study is predicting the occurrence of a sex offence based on crime frequency and types of crime. Therefore, the two following hypotheses were tested; H1: Sex offenders do not have distinctive criminal trajectories based on crime frequency prior to their first sex offence compared with age-matched nonsex offenders, and H2; Types of crimes can predict the likelihood of a subsequent sex offence. Using longitudinal criminal career data and conducting group based trajectory modelling (N=4142) and a multinomial probit regression analysis (N=4130) induced the following conclusion; while sex offenders do not seem to be different from nonsex offenders based on their crime frequency up to the first sex offence, it is possible to predict the impact of committing a property offence on the likelihood of committing a subsequent sex offence.

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1.Introduction

Sex offending is a serious offence that leads to a lot of physical and psychological damage among its victims. In the Netherlands, numbers of registered sexual offences have declined from 9.720 to 8.190 per year between 2010 and 2014 (Central Bureau for Statistics, 2017). However, it may be assumed that the actual numbers of sex offences are higher since there are many sexual offences that do not get reported for reasons such as shame or because the victim may know the offender. In other words, there may be a high dark number of sex offences ("Publicaties en Cijfers", n.d.). It is important for the wellbeing of potential victims as well as the society as a whole to decrease the number of sex offences as much as possible using policy instruments. Dutch policies regarding sex offenders are different from nonsex offenders. For example, when a person wants to apply for a certificate of conduct, the applicant will be checked for offences he or she committed in the past 2-4 years (with some special cases for specific jobs that can take up to 30 years). This certificate of conduct is a necessary document for many jobs in the Netherlands. However, sex offences are treated differently. These offences will be taken into account for the rest of the offender's life for the application of a certificate of conduct. This means the sex offender will have lifelong troubles receiving the certificate of conduct. ("Terugkijktermijnen", n.d.)

This policy was made for several reasons (Boone, 2011); one of them was that policy makers aimed at protecting the public from sex offenders by not letting them occupy a job based on any kind of dependency. However, this policy could also entail some negative consequences. Criminological research shows that employment is negatively associated with recidivism (Uggen & Staff, 2001). So by excluding sex offenders from employment, policy makers could be actually increasing recidivism rates. It is therefore important to develop accurate policy instruments that reduce sex offending and do not entail such negative unexpected consequences. For example, policy could be made effectively if one could find

predictive patterns for sex offending, which is the main topic of the present study. In the present study, the 10-year period prior to the first sex offence will be studied, to find out whether we can find predictive factors in crime frequency and/or type of crime. Policy instruments could be made more accurately when we can prevent the occurrence of a sexual offence by knowing what predictors increase the risk of a subsequent sex offence. The main theme of the present study will thus be the extent to which the occurrence of the first sex offence can be predicted.

First of all, this study investigates how the crime frequency of sex offenders up to their first sex offence differs from other types of offenders. For studying the criminal trajectory prior to the first sex offence, I will take studies and theory into account that study the difference between the entire criminal career of sex offenders and nonsex offenders, since we may assume that if the entire criminal career is not distinct, this would also account for the period up to the first sexual offence. Some studies have found that sex offenders tend to have a specialised and persistent criminal career: they will persistently commit specialised crimes (sex offending in this case) throughout their lives (Harris, Smallbone, Dennison & Knight, 2009; Jennings, Piquero, Zimring & Reingle, 2015). This view that sex offenders are a distinct type of offenders and are more dangerous than other types of offenders is also the popular view that is held in societies (Zimring, 2004). This view resonates in many policy interventions treating sex offenders differently than nonsex offenders, such as the policy in the Netherlands (Boone, 2011). However, a vast amount of research has also found support for the fact that the criminal careers of sex offenders are just like the ones of other types of offenders (Jennings, Piquero, Zimring & Reingle, 2015). Thus there is controversy in the way that the scientific as well as the societal world views sex offenders; are they distinct or similar to other types of offenders? Since the main subject of the present study is predicting the onset of sexual offending, it is important to first investigate whether sex offenders differ from

nonsex offenders in their crime frequency trajectory up to this first sex offence. If they differ, namely, crime frequency would be a predictive factor in determining who will commit a sex offence. After addressing the extent to which criminal trajectories of sex offenders are distinct from nonsex offenders, I will investigate how types of crimes could predict the occurrence of the first sex offence while controlling for crime frequency. Thus, the following two research questions will be addressed in chronological order;

1. *To what extent do sex offenders have distinctive criminal trajectories based on crime frequency prior to the first registered sex offence compared with age-matched nonsex offenders?*
2. *To what extent do types of crime in the criminal trajectory predict the likelihood of a subsequent sex offence?*

To answer the first question, sex offenders will be age-matched to nonsex offenders. A sex offender is regarded as an offender who committed at least one sexual offence in his or her criminal career. A nonsex offender is regarded as an offender who has not committed any sexual offence in his or her criminal career. Then, the criminal trajectories (with a duration of 10 years) of a) sex offenders up to the year of their first sex offence; will be compared with those of b) nonsex offenders up to the year that their age-matched sex offenders commit their first sex offence. For simplification reasons, this year is called year zero. A criminal trajectory (also called criminal career or criminal history) is the sequence of crimes committed by an individual offender (Blumstein et al., 1986). The present study will only look at crime frequency in comparing the trajectories in the first part of the study. For the second research question, the types of crime under scrutiny are property, damage and violent crimes that are committed during the 5 years prior to the first sex offence. The present study is unique in the

sense that little to no research has been done yet on the predictive offences of sex offenders. Addressing the topic using such a large sample of crime in the Netherlands makes the study even more useful in contributing to the existing literature (Blokland, Nagin & Nieuwbeerta, 2005). The dataset I will use is a subsample from the Criminal Career and Life-Course Study (CCLS). This study was conducted by the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR). This dataset is appropriate for the present study since it contains criminal records of about 800 sex offenders, and their criminal behaviour was followed for most of their lives. For addressing the first research question group based trajectory modelling analysis will be used. For the second research question a multinomial probit regression will be performed.

I will first discuss relevant theories and research on the topics. From this information, hypotheses will be derived which will be tested with the methods mentioned above. The results of these tests will be useful to make suggestions regarding the literature on this topic as well as the policy for reducing sex offending. The results, implications, strengths and limitations of the study will be discussed at the final part of the study.

2. Theoretical Framework and Literature Review

2.1 Comparing Criminal Trajectories

In explaining how crime frequency differs between different types of offenders one can apply a general as well as a crime-specific approach (Piquero, 2000). The general approach implies that mechanisms that cause crime can cause *any* type of crime, which thus suggests that criminal trajectories based on frequency do not differ between different types of offenders (Piquero, 2000). In this section I will discuss some general theories of crime that will explain how crime emerges without distinguishing between types of crime. These theories are applicable to all types of offenders and do not suggest that one crime-specific offender is more persistent than another. On the other hand, the crime-specific approach

implies that mechanisms differ for different types of offences which thus suggests that criminal trajectories may differ between different types of offenders. Therefore, I will also discuss some crime specific theories. Since the criminal trajectories up to the first sex offence will be studied, it may be assumed that if criminal trajectories of different types of offenders are expected to be similar throughout the whole criminal career based on the theory, this would also hold for the period up to the first sex offence in comparing sex offenders to nonsex offenders.

To start with, it is helpful to say something about the typical pattern of crime frequency. The age-crime curve is a very common way to describe crime frequency over the life course (Farrington, 1986). This curve is a well-known average relation between age and crime frequency of the general population of offenders. This pattern of offending typically peaks during the ages of 18-20, steeply decreases after this age and then gradually decreases more slowly the older the offenders get (Farrington, 1986). Terrie Moffitt's dual taxonomy theory addresses this curve by distinguishing between types of offenders and explaining the mechanisms behind the curves (1993). This dual taxonomy theory is the first major theory addressed in the present study that could explain whether sex offenders differ in their criminal career from nonsex offenders.

The main argument of this theory is that offenders can be classified in two types of offenders: the adolescence-limited offender [AL] (offending only occurs during adolescence) and the life-course-persistent offender [LCP] (offending occurs during the whole life course). Moffitt suggests that most offenders are adolescence-limited offenders (1993). The crime committed by this group of offenders is caused in two ways: first of all, Moffitt argues that adolescents experience a gap between the extent to which their body has developed into maturity and the way society views the adolescents as mature. More specifically, the adolescent body has already developed into maturity for a great deal while society still

regards these adolescents as children. This sense of strain will lead to antisocial behaviour (Moffitt, 1993). Second of all, the peer influence that adolescence-limited offenders experience in their younger years causes them to show more deviant behaviour, which declines after they adapt a more adult lifestyle when they get older. Having a job, getting a partner and losing the deviant friends are examples of causes that make the AL type of offenders stop committing crimes when they reach adulthood (Moffitt, 1993).

The second group of offenders explained by Moffitt, life-course-persistent offenders, show criminal behaviour throughout their whole lives due to certain characteristics of their brain and due to social characteristics of the offender. This could be tragic events that have happened in the offender's life such as abuse and neglect, or because of the socioeconomic status of the offender or deviant behaviour of the parents of the offender (Moffitt, 1993). The theory of Moffitt can hold different interpretations in predicting how distinctive the criminal trajectories of sex offenders are. Firstly, based on the typology of LCP offenders, a sex offender would not have a different criminal career regarding persistence than a nonsex offender since both sex offenders and nonsex offenders can become life-course-persistent offenders due to the factors mentioned above. However, one could also strive for the opposite idea: sex offenders may have a higher chance in being a life-course persistent offender since it may be more common that people who end up committing a sex offence have tragic events that have happened in their lives. For example, a review of the existing literature on this topic showed that on average about 28% of the sex offenders have been a victim of sexual assaults in their childhood (Hanson & Slater, 1988). Also, the theory of Moffit implies that serious criminals have a higher chance of being a LCP offender. Since sex offending accounts for serious crime, this would suggest that sex offenders would follow a more life-course-persistent criminal trajectory than less serious offenders. Despite the fact that this last argument would imply that sex offenders (serious offender type) would be more persistent in

their offending frequency than for example property offenders (less serious offender type), this argument would not hold when comparing sex offenders (serious offender type) with for example murderers (serious offender type). These are namely both serious types of offenders, which would mean according to Moffitt that they both have a high chance in being a LCP offender (1993).

Another general theory of crime is the self-control theory of Gottfredson and Hirschi which explains that crime occurs when people that have low self-control come into the opportunity to commit a crime (1990). They state that this low self-control develops during childhood by factors such as bad parenting, and usually this self-control increases with age because of processes such as socialization and biological maturation (Gottfredson & Hirschi, 1990). If we assume that the amount of crime that an offender commits is directly linked to the extent to which a person has self-control, then this would account for any kind of crime. If a person has no self-control in general, it can be assumed that this low self-control accounts for any type of crime he or she wants to commit. Thus, based on the self-control theory we could predict that sex offenders do not have distinctive criminal trajectories based on crime frequency.

However, there are some theories that imply that crime-specific mechanisms for explaining criminal behaviour do exist. The routine activity theory, for example, does not agree with the idea that crime frequency is generated by general mechanisms that cause any type of crime instead of specific crimes (Cohen & Felson, 1979). Instead, this theory builds on the idea that crimes happen in situational contexts where the circumstances of offending a specific crime are ‘favourable’. Routine activity theory states that activities that happen every day provide offenders with certain targets. Daily activities such as going to work may put material or personal targets in accessible places for offenders (Cohen & Felson, 1979). This theory can be interpreted in different ways regarding the topic under study. For example,

since robbery is possible without witnesses, and sexual assaults are not (the victim is the witness), the routine activity theory could imply that property crimes are committed more frequently than sex offences. However, the theory could also be interpreted in such a way that sex offences can happen frequently as well because parents may leave their children alone at home when they go to work, which may make the children targets of child molestation.

In sum, there are theories that explain crime-specific behaviour as well as general-crime behaviour which may both be used in explaining how sex offenders are or are not distinct from nonsex offenders in their crime frequency curve up to the first sex offence. To be able to derive a fitting hypothesis for the present study, prior literature on this topic will now be discussed.

2.2 Prior Research on Comparing Criminal Trajectories

The general thoughts on sex offenders have for a long time been that they are more specialised and persistent offenders than nonsex offenders (Harris, Smallbone, Dennison & Knight, 2009; Jennings, Piquero, Zimring & Reingle, 2015). Sex offenders are not only treated as a separate group of offenders in literature, but also by the society as a whole and public policy (Zimring, 2004). As described in the introduction, the specialised treatment of sex offenders in public policy of the Netherlands implies that policymakers base policies on the assumption that sex offenders are distinct from nonsex offenders. However, results from some recent studies show support for the idea that criminal careers of sex offenders are not more specialised or persistent than those of nonsex offenders (Jennings, Piquero, Zimring & Reingle, 2015).

With regard to addressing the extent to which sex offenders have distinctive criminal trajectories up to their first sex offence compared with nonsex offenders based on crime frequency, I will discuss the issue of general recidivism. General recidivism is the extent to which an offender commits any type of crime throughout their criminal trajectory, thus how

persistent they are. I will discuss results of previous literature regarding general recidivism of sex offenders compared with nonsex offenders over their *whole* criminal career, since one can assume that if sex offenders have distinctive crime frequency curves up to their first sex offence, this would also hold for the whole criminal career.

The available research that compares the general recidivism of sex offenders with nonsex offenders shows mixed results, which is in part due to the differences in methodology of the studies (Jennings et al., 2015). Caldwell has summarised available research that mostly indicates that the general recidivism rates of sex offenders are lower than those of nonsex offenders (2002). In addition, the results of Sipe et al. indicate that the juvenile nonsex offenders have a higher rate of adult general recidivism (1998). Langan and Levin have conducted a large study on recidivism of prisoners released in 1994 (2002). Their results suggest that the general recidivism rates are not higher for sex offenders than for nonsex offenders. More specifically, they found that, within 3 years, sexual assaulters show a general recidivism rate of 41%, rapist show 46%, murderers show 41%, and property offenders show 74% general recidivism rates. Another study of general recidivism of prisoners also shows that the general recidivism of sex offenders is 25% lower than that of nonsex offenders (Langan, Schmitt, & Durose, 2003). In addition, Sample and Bray (2003) have shown that sex offenders are not more dangerous than other types of offenders based on their general recidivism. In a follow up period of 5 years, they found that sex offenders show general recidivism rates of 45%. This recidivism rate is one of the lowest compared with the other groups analysed in their study, only murderers (44%) and property damagers (39%) show lower recidivism rates. Other groups, such as robbers (75%), burglars (58%) and nonsexual assaulters (58%) show higher general recidivism rates than sex offenders.

Another study that used data from released prisoners in 1994 is a study directed towards the persistence of sex offenders by Miethe et al. (2006). The results of this study

suggest that sex offenders have low levels of persistence in absolute numbers and also compared with other types of offenders, namely violent offenders, property offenders and public-order offenders. Zimring et al. have conducted two large birth cohort studies to examine the sexual and nonsexual reoffending rates of juvenile sex offenders (2007, 2009). Their results show similar results compared with Miethe et al. (2006) and most of the other literature discussed above, namely, sex offenders are similar to nonsex offenders in their criminal career patterns based on frequency. If sex offenders show similar patterns to nonsex offenders, this can also imply that the crime frequency curve up to the first sex offence is also similar to that of age-matched nonsex offenders. Thus, the hypothesis for the first part of the present study is as follows; *H1: Sex offenders do not have distinctive criminal trajectories based on crime frequency prior to their first sex offence compared with age-matched nonsex offenders.*

To be able to confirm this hypothesis, the trajectory groups found in the group based trajectory modelling should constitute about the same proportion of the total sex offenders as nonsex offenders. If this hypothesis would be false, the sex offenders would constitute an entire trajectory on their own or be highly concentrated in one or more trajectories. Despite the prediction that sex offenders do not have distinctive criminal trajectories based on crime frequency, there might be other characteristics of the criminal trajectory of sex offenders that do differ from nonsex offenders, for example regarding the types of crimes they commit. The second part of this study therefore focuses on types of crime as predictors for a sex offence.

2.3 Predicting a Sex Offence

The criminal career paradigm emerged in the 1980s, when new policy strategies were needed to reduce the quickly expanding crime rates in the United States (Blokland & Lussier, 2015). This paradigm focuses on the criminal activity of an individual offender instead of the aggregate numbers of crimes per capita. The specific definition of a criminal career according

to the Panel of Criminal Career Research is 'the characterization of the longitudinal sequence of crimes committed by an individual offender' (Blumstein et al., 1986: p. 12). The four key dimensions that characterise a criminal career are participation (who engages in crime?), frequency (how much criminal activity do offenders show?), seriousness (how serious are the offences that are committed) and career length (for how long is an individual active as an offender?). The criminal career paradigm has been expanding ever since (Blokland & Lussier, 2015).

In 2004, Soothill et al. express their disapproval to the extent to which the criminal career paradigm had developed up until then. According to them, the criminal career paradigm had focused more on the quantity of crime instead of the types of crimes committed. In their paper, they suggest a new typology of criminal activity, for example by focusing more on type of criminal activity than quantity and by examining shorter trajectories rather than a whole life course. They propose this typology because they perceived that previous offences may serve as indicators that can predict a certain offence (Soothill et al., 2004). Soothill et al. also came with a distinction between indicators and precursors of subsequent serious offences. Indicators are offences that characterise the present situation, whereas precursors can identify how the future will unfold regarding offences and are thus related to future behaviour (2002). Soothill et al. state that the use of criminal trajectories in predicting offences has been neglected by criminological theory in general (2004).

Despite the fact that a theoretical framework regarding predictive patterns in criminal careers has not been developed yet, a couple of existing theories could be useful for finding a hypothesis for the present study. First of all, Sampson and Laub explain how escalation over the criminal career can occur (1997). This term refers to the idea that the crimes in the criminal career increase with seriousness. One theory that explains how escalation can occur is called cumulative disadvantage. Cumulative disadvantage is a phenomenon where criminal

acts can cause more criminal acts because being convicted for a crime can lead to a decrease in social bonds. A decrease in social bonds, in turn, can enhance an increase in the seriousness of offending behaviour. This can be explained by Hirschi's social control theory (1969), which suggests that a lack of social bonds to actors that prohibit antisocial behaviour, such as family or friends, can increase criminal activity (Hirschi, 1969). To illustrate this, suppose that a conviction leads to a loss of job or a divorce, which decreases the social bonds with others (family-in-law, colleagues). This decrease of social bonds may lead to more criminal behaviour because these social actors often prohibit deviant behaviour. A decrease in social bonds means that the individual has less to lose when he or she commits a more serious offence. It may also be that the criminal will have a hard time coming back into the marriage market or labour market in general after this conviction because of bad reputation caused by the conviction. This will lead to more serious criminal behaviour, and it can thus be expected that the criminal career will escalate in seriousness because of negative side effects of each crime (Sampson & Laub, 1997). Thus, based on this theory, we could assume that sex offences happen in a period of escalation. However, if we would assume that committing a sex offence happens in a period of escalation, we still do not know *when* during this escalation the sex offence will occur. Also, this escalation in seriousness does not mean it will only lead to sex offending, serious offences such as homicide could also be the result of cumulative disadvantage.

The theory of self-control brought forward by Gottfredson and Hirschi is not only useful in explaining crime frequency, but types of crimes as well (1990), since they state that people that have low self-control and come into contact with illegal opportunities will commit certain crimes. Thus another way to speculate on how predictive patterns for sex offences may look is focusing on where in the criminal career the opportunity for such a crime could take place (Gottfredson & Hirschi, 1990). For example, it could be reasoned that a burglary

can bring offenders into the opportunity of committing a sex offence, since they have trespassed the property of a potential victim for committing the burglary. This opportunity of committing a sex offence in combination with low self-control may result in the occurrence of a sex offence.

Building on this last argument, one could argue that people may commit a sex offence after being convicted for specific types of other offences that are directly related to sex offences. For example, a person that will commit a sex offence might be stalking his potential victim first. Similarly, as mentioned above burglaries might take place at the property of the victim before the offender commits a sex offence. Some studies support this idea and have found types of crimes that predict other types of crimes. These studies will be discussed in the following paragraph.

2.3 Prior Research on Predictive Offences

To my knowledge, there are little to no studies on predictive patterns in criminal behaviour prior to a sex offence. The present study will thus be one of the first to direct this particular question. Despite the fact that there has been little to no research done in predicting a sex offence based on the criminal history of the offender, limited studies have aimed at finding predictive patterns in the criminal careers prior to other serious offences. Most of the research done in this topic has been done by Keith Soothill. I will now discuss his and his colleagues' work in chronological order.

In 2000, Soothill and Francis have conducted a study where they researched around 7000 sex offenders that were convicted for a sex offence in England and Wales in 1973. They investigated whether these sex offenders were more likely to commit a homicide than the general population. The answer is yes. The sex offenders have a chance of 1/400 compared with a chance of 1/3000 for the general population to commit a subsequent homicide. This

study is the first study of Soothill where the criminal history of an individual is used to predict a subsequent offence (Soothill & Francis, 2000).

In 2002, Soothill et al. have conducted a study where they searched for the relationship between the criminal history of an individual and the risk to commit a subsequent serious sexual assault of an adult female. This is thus one of the few studies that is aimed at predicting a sex offence. The sample consisted of 1057 males under the age of 45 who were convicted for a serious sexual assault or rape for the first time in 1995-1997. The findings suggest that being convicted for a prison sentence for committing the crimes 'other wounding', robbery, stealing in a dwelling, arson, kidnapping and cruelty to children, increases the risk of a subsequent serious sexual assault (Soothill, Francis, Ackerley & Fligelstone, 2002).

In 2008, Soothill et al. addressed the issue whether one can predict when a homicide will take place in a criminal trajectory based on four preliminary serious crimes (arson, blackmail, kidnapping and threats to kill). Specifically, they first examined how specialisation of one of the four crimes and escalation may predict the homicide. Afterwards, they looked for certain combinations and sequences of the four crimes per case, to see how these combinations and sequences can form risk factors for the subsequent homicide. They used large datasets of offenders that have been convicted between 1979 and 2001 in England and Wales for one of the four focused crimes. They found that, first of all, the type of the first serious offence is a significant predictor for the subsequent homicide. For example, a person whose first offence is a kidnap has a 48% higher risk in committing a homicide, and a person who starts with threats to kill has a 55% higher risk of committing a homicide over an arson offender. The results of their study also show that the offenders who committed multiple different types of serious offences are more likely to commit a homicide than those specialising in their first serious offence. A person who committed two distinct crimes is

nearly twice as likely to commit a subsequent homicide than a person who only committed one type of serious offence (Soothill et al., 2008).

The literature review mentioned above shows that research aimed at finding predictive patterns in criminal behaviour for a specific type of offence is scarce, and that there are almost no studies that investigate predictive patterns prior to a sex offence, except for the study of Soothill et al. (2002). However, studies aimed at predicting other serious offences, such as the study that predicted how types of crimes increase the risk in homicide (Soothill et al., 2008), do show results that imply crimes can be predicted using the offenders' criminal history. After controlling for crime frequency, the present study will use Soothill's and colleagues' study as an inspiration for predicting sex offences instead of homicides, and will hereby meet the shortcoming of information in criminological literature regarding predicting a sexual offence. The expectation for the second part of the present study based on the literature review and theoretical framework mentioned above is as follows; *H2: Types of crimes can predict the likelihood of a subsequent sex offence*. To confirm this prediction, the multinomial probit regression should show that certain types of crimes increase the likelihood of a subsequent sex offence. The two hypotheses that were derived from the theoretical framework and literature review discussed above shall be tested in the next sections.

3. Data and Methods

3.1 Original Sample

The sample used to test the hypotheses is based on the Criminal Careers and Life-Course Study (CCLS) dataset. The CCLS project was conducted by the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR) (Blokland, Nagin & Nieuwbeerta, 2005). The sample is a representative sample of 4% of all persons who were tried by a judge for a serious offence in 1977 or who were decided on by a public prosecutor. The sample was weighted by offence types to gain an accurate representation of all individuals tried in 1977.

Retrospective and prospective information such as life-course information (e.g. marriage, fertility history and death records) and conviction data was used to describe the people in the sample for which this information was available. Since this information was not available for all persons in de sample, this step reduced the sample somewhat. The people in the sample used in the present analysis were followed until 2006 or death and the sample consists of an age range of 12 to 91. The General Documentation Registry of the Ministry of Justice Court Documentation Service was used to be able to register the entire criminal career of the persons in the sample. This registry provided all criminal cases of the individuals from 1977 on registered by public prosecutors. These only include crimes committed in the Netherlands. The sample consists of 4167 individuals, from which 11 percent are female offenders (Blokland, Nagin & Nieuwbeerta, 2005). The data is a person-year file, which means that each case represents a year for a person.

3.2 Final Sample

Using the original sample, several restrictions and measures were made for the present study. Since only five sex offenders were women, all women were deleted from the sample. A variable was constructed to indicate who in the sample is a sex offender (everybody who committed at least one sex offence in their criminal career) and who was a nonsex offender (everybody who has not committed any sex offences in their criminal career). Since the group of sex offenders is relatively small (about 20% of the total sample), a distinction between different types of sex offenders was not made. Next, an age-matched group was created of sex offenders and the nonsex offenders. This was done by matching multiple nonsex offenders to each sex offender based on the age of the sex offender at their first sex offence. This was done for each birth cohort (these cohorts are groups of 5 years between 1910 and 1964). For the present study, the criminal careers are restricted to 10 years up to the first sex offence for the sex offenders, and for the nonsex offenders up to the year at which an age-matched sex

offender commits his first sex offence. For simplification purposes, this year will be referred to as year *zero*. It is thus important to note for the present study that the years represented in the criminal trajectories refer to the number of years prior to year zero, and not to actual calendar years or ages. The final sample used in the first analysis consisted of 3365 nonsex offenders and 777 sex offenders (4142 in total). Since for the second analysis (multinomial probit regression) the goal is to predict what crime one is going to be committed in year zero, the 12 people who died before year zero were deleted from the sample and thus the sample for the second analysis consisted of 3353 nonsex offenders and 777 sex offenders (4130 in total).

3.3 Operationalization

There were multiple dependent and independent variables used for the analyses. The descriptive statistics of these variables are given in Table 1.

Table 1

Descriptive Statistics of Used Variables

Variable	N	Minimum	Maximum	Mean	STDEV
First Analysis					
Total convictions in 10-year period	4142	0	101	3.10	5.62
Proportion free per year	4142	0	1	.94	0.18
Second Analysis					
Age at year zero	4130	13	66	24.94	9.77
Crime at year zero	4130	1	3	2.39	0.78
Birth cohort	4130	1	11	1950-1954	
Trajectory group	4130	1	5	-	-
Group 1	*115(2.78%)*	0	1	-	-
Group 2	*2938(71.14%)*	0	1	-	-
Group 3	*343 (8.31%)*	0	1	-	-
Group 4	*611 (14.79)*	0	1	-	-
Group 5	*123 (2.98)*	0	1	-	-
At least 1 violent offence	4130	0	1	10%	-
At least 1 property offence	4130	0	1	30%	-
At least 1 damage offence	4130	0	1	11%	-

Notes. 12 people died before year zero and were not taken into the second analysis/ The variable trajectory group was divided into 5 dummy variables with group 2 as the largest group/ most people fall into birth cohort 9 which is 1950-1954

For the first analysis, crime trajectories were estimated over the period of 10 years prior to year zero (ytosex = -10 to ytosex = -1). This was done with the variable *yftotal* which

is the sum of total crimes of each year. Since it should be taken into account that people cannot commit crimes while in prison, this analysis was controlled by the variable *free*, which is the proportion of not being incarcerated in each year. For the second analysis, it was tested whether types of offences can predict a subsequent sex offence using a multinomial probit regression. The dependent variable, *delict0*, is the crime they committed in year zero. This variable had three outcomes; a sex offence, a nonsex offence, or no offence. The predictors were *violent, damage* and *property*, which are variables that indicate how many people have committed at least one violent- damage- or property offence within the 5-year period before year zero. This prediction was controlled for the age people had at year zero, the birth cohort they are in and the trajectory group they are in (thus for crime frequency). This last variable was determined by the previous analysis (trajectory analysis).

3.4 Analyses

The data was analysed in several steps using STATA. First, semi parametric group-based trajectory modelling was conducted by using the *traj* plugin to estimate the underlying distinct groups of offenders that show similar patterns of conviction rate over time (Nagin, 1999). This is a method that estimates the underlying crime curves distributed over a number of distinct groups that follow the same trajectory based on frequency. It is thus a good procedure to check how different types of people are distributed over different crime curves. For the analysis, the zero-inflated Poisson model was used. This is a model that makes sure that short periods of non-offending do not result in changes in the offending trajectory. The model used a cubic relationship for the crime curve over time based on the following formula (the linear and quadratic model were tested as well, but turned out to be less fitting than the cubic model);

$$\log(\lambda_{it}^{j}) = \beta_0^j + \beta_1^j \,\mathrm{Time}_{it} + \beta_2^j \,\mathrm{Time}_{it}^2 + \beta_3^j \,\mathrm{Time}_{it}^3$$

where λ_{it}^{j} indicates the expected number of convictions of person *i* at time *t* given his membership in group *j*. The time over which the curve was estimated was the 10 years up to year zero. Time_{it} indicates the amount of years prior to year zero at time *t*, for Time_{it}^{2} this is squared and for Time_{it}^{3} this is cubed. β_0^j, β_1^j, β_2^j and β_3^j are the coefficients that determine the shape of each trajectory. The denotation of *j* indicates that the coefficients vary across the groups. The crime trajectories were controlled for the proportion that the offenders were in prison.

A key step in this analysis is determining how many distinct groups can be identified in the data. To determine this number, the Bayesian Information Criterion (BIC) is used. The higher the BIC value, the better the model fits. However, in determining the right number of distinct groups, the BIC number is not the only important criterion since the BIC number in the used sample gets higher every time another group is added to the model. For each model, it was thus also checked whether the visual representation of the graph was in line with the average numbers of crimes for each year within each group. Since estimating a trajectory model is done for simplification of the data, the maximum number of distinct groups to be tried in the model was 6. After the trajectory groups are formed, individual probabilities of group membership were determined. This posterior probability of group membership is used to be able to assign the individuals to the right crime curve. The mean probability should not be lower than .70 for each trajectory in the estimated model. The final step is determining how the sex offenders are distributed over the different trajectories. The analysis described up until now will answer the first research question.

To perform the remaining analysis for the second research question, the trajectory group assignment was added to the data for each individual. A multinomial probit regression was performed using STATA, since the aim of the second research question is predicting a nominal dependent variable with three categories. The analysis was used to test whether

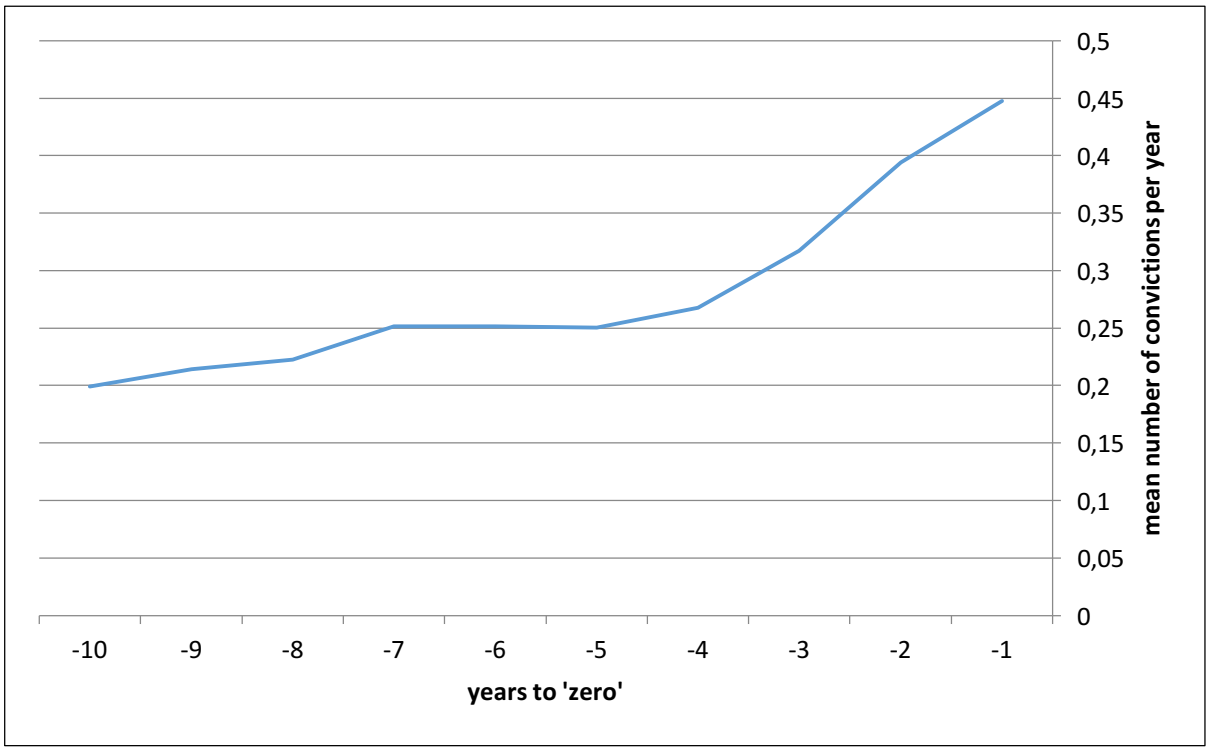
having committed at least one violent- damage- or property offence in the 5 years up to zero predicted which crime was going to be committed in year zero (a sex offence, a nonsex offence or no offence). This prediction was controlled for age at year zero, birth cohort and the trajectory group people belonged to (thus crime frequency over time). A probit regression was used instead of a multinomial logistic regression since the assumptions on this latter model were violated.

4. Results

The results of the analyses are as follows. First of all, the crime curve up to year zero averaging all individuals in the sample is plotted in Figure 1. This figure indicates that the mean number convictions increase gradually over time, with about 0.5 mean convictions in the year prior to zero. However, this average crime curve may obscure underlying distinct groups of offenders who follow similar trajectories. This possibility was addressed in the group based trajectory analyses.

Figure 1

Average Crime Curve for Entire Sample (N=4142)



After conducting the group based trajectory analysis, it became clear that there were indeed distinct underlying groups that followed similar crime curves. The response variable was the number of convictions every year up to the year before zero. Multiple models were tested to find which model of trajectories fitted best. The BIC score of the four-group cubic model was -18408.95. The five-group cubic model had a better BIC score; -18339.47. Even though the BIC score of the six-group model improved even further (-18303.72), the individual groups were too similar in this model. In addition, some of the posterior group probabilities of the six-group model were lower than the threshold of .70. Based on the numerical and visual criteria that were tested as described in the method section, the five-group cubic model came out to be the best fitting model. The visual representation of this model is represented in Figure 2. The numerical values of this graph are represented in Table 2. The posterior probabilities for group assignment are represented in Table 3.

Figure 2

Estimated Trajectories for the Five-group Cubic Model

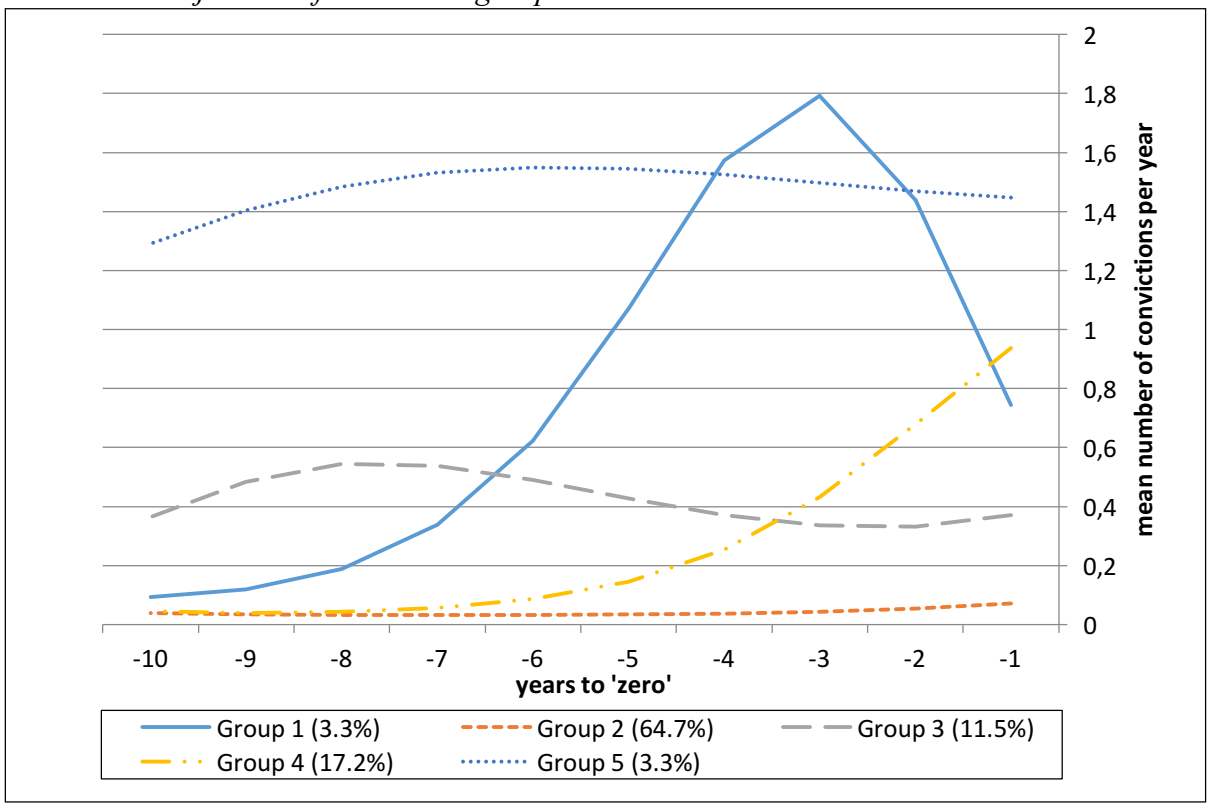


Table 2

Numerical Values of Parameter Estimates for the Five-group Model

	Group 1	Group 2	Group 3	Group 4	Group 5
Intercept	-0.05190	5.21644***	1.00159***	3.84286***	1.62597***
Linear	-1.49985***	0.37003*	0.37769*	0.02325	-0.00016
Quadratic	-0.31517***	0.03477	0.10495**	-0.12088**	0.00674
Cubic	-0.01564***	0.00073	0.00702***	-0.00915**	0.00078
free_1	-1.45072***	-7.52201***	-1.71187***	-3.77114***	-1.26216***

*Note. *=p<.05; **=p<.01; ***=p<.001*

Figure 2 shows that Group 1 and Group 5 make up a small proportion of the population, Group 3 and 4 a larger proportion and Group 2 the largest. Group 2 shows a constant line with little to no crime frequency in the 10 years prior to zero. Group 5 seems to do the opposite; this group of offenders show a more or less constant line of relatively a lot of offences during the 10 years prior to zero. Group 1 shows a steep increase in crime frequency up until 3 years prior to zero, where after they show a steep decline up until the year prior to zero. Group 4 shows a gradual increase in crime frequency, and finally Group 3 shows an increase, a decline and another increase during the 10 years prior to zero. Since Group 2 is the largest group, most people in the population are expected to show little to no crime frequency in the 10 years up until zero. Age and other characteristics of the groups are discussed later.

Table 3

Mean Assignment Posterior Probability

Assigned group	Group 1	Group 2	Group 3	Group 4	Group 5
Group 1	.79	.00	.05	.04	.04
Group 2	.00	.88	.06	.10	.00
Group 3	.07	.04	.79	.09	.05
Group 4	.07	.07	.07	.76	.01
Group 5	.07	.00	.03	.01	.91

Note. All posterior probabilities of the accurate group are higher than the threshold of .7

Table 3 shows the posterior group probabilities. These are all above the threshold of .70, which means that this trajectory model assigns the individuals to the accurate crime

curves and thus seems to be a fitting model. The group that each individual belongs to, which became clear in this first analysis, were matched to the data to be able to conduct the second analysis which is discussed later.

First, to be able to answer the first research question, it is explored how the sex offenders are distributed over the trajectory groups. This distribution is indicated in Table 4. The percentages are the percentages of the total group of (non)sex offenders.

Table 4

Distribution of Sex Offenders and Nonsex Offenders over the Trajectory Groups

	sex offenders (n=777)	nonsex offenders (n=3353)	Total population
Group 1	20 (2.6%)	95 (2.8%)	3.3%
Group 2	544 (70%)	2394 (71.4%)	64.7%
Group 3	67 (8.6%)	276 (8.2%)	11.5%
Group 4	109 (14%)	502 (15%)	17.2%
Group 5	37 (4.8%)	86 (2.6%)	3.3%

As shown in Table 4, the percentages are similar within each group, which indicates that sex offenders do not have distinct criminal trajectories in the 10 years prior to their first sex offence compared with age-matched nonsex offenders. However, Group 5 does show some difference; 4.8% of the total sex offenders follow trajectory 5 whereas 2.6% of the total nonsex offenders follow trajectory 5. This is a relatively large difference. However, this does not say that this difference is statistically significant. In addition, trajectory group 5 is a small proportion of the total population (3.3%), thus this difference may be due to the small group size. Having said that, the sex offenders and nonsex offenders are distributed quite evenly over the remaining trajectories, so the first hypothesis may be confirmed for the most part. The third column of Table 4 shows that the percentages of the distribution over the groups of the two types of offenders are in line with the distribution over the trajectories of the entire population.

Since only the whole sample was age-matched but not the trajectories itself, it is informative to compare the average age of sex offenders with nonsex offenders within each trajectory. These average ages at year zero and average birth years are given in Table 5. The average ages at year zero and the average birth years do not differ much between the two types of offenders, thus age does not seem to influence the notion that the crime trajectories of sex offenders are not distinct from nonsex offenders.

Table 5

Average Age of Sex offenders and Nonsex Offenders Within Each Trajectory

	Average age at 'zero'		Average birth year	
	Sex	nonsex	Sex	nonsex
Group 1	28	25	1951	1953
Group 2	24	24	1948	1949
Group 3	30	30	1948	1949
Group 4	23	24	1950	1953
Group 5	32	29	1953	1952

Now we go to the second analysis of the present study; test whether certain types of crimes can predict a subsequent sex offence. Therefore, we need to explore what types of offences are committed in year zero. A distinction was made between people who committed a sex offence, a nonsex offence or no offence at all. For this prediction, the years under scrutiny were 5 years prior to zero. It was found that the most common offences in these years were violent offences, property offences and damage offences. Therefore, only these three types of offences were used as predictors for a subsequent sex offence, since the other types of offences did not have enough hits to be used in an analysis.

Using these three types of offences, a multinomial probit regression was conducted using STATA. The dependent variable was type of crime committed in year zero, which could be a sex offence, a nonsex offence or no offence. The predictors were having committed at least one violence, one damage or one property offence in the 5 years up to zero.

The analyses were controlled for age at year zero, birth cohort and the trajectory that people belonged in. The results of the analyses are displayed in Table 6.

Table 6

Parameter Estimates for Multinominal Probit Regression (N=4130)

Wald Chi² (18)	435***
Log likelihood	-3759.8085

Crime at zero		B Coefficient	SE
Sex offence	Intercept	-0.559*	.238
	Damage	0.011	.119
	Property	0.343***	.088
	Violent	0.090	.114
	Group1	0.360	.229
	Group3	0.211	.128
	Group4	0.115	.113
	Group5	0.879***	.214
	Age	-0.011*	.004
	Cohort	-0.029	.019
Nonsex offence	Intercept	-2.108***	.271
	Damage	0.127	.109
	Property	0.649***	.083
	Violent	0.045	.107
	Group1	0.961***	.202
	Group3	0.522***	.122
	Group4	0.481***	.105
	Group5	0.911***	.205
	Age	-0.009	.005
	Cohort	0.129***	.021

Note. The reference category is 'no offence'
**=p<.05; **=p<.01; ***=p<.001*

The results of the multinomial probit regression that are displayed in Table 6 can be interpreted as follows. First of all, the overall fitted model has a Log likelihood of -3759.8085 and is statistically significant (Wald Chi² (18) = 435, p<.001) which means that the overall predicted model tested here is better than a model with no predictors. Next, the individual coefficients will be discussed. As displayed in Table 6, of the crime types only property offending has a significant effect on the likelihood of committing a sex offence. Thus, keeping trajectory group, age, and birth cohort constant, having committed at least one property crime during the 5 preceding years increases the predicted probability of committing

a subsequent sex offence versus not committing any offence (B=0.343, z=3.92, p<.001). This result suggests that hypothesis 2 is partly confirmed (*H2: Types of crimes can predict the likelihood of a subsequent sex offence).*

Hypothesis 2 is only partly confirmed because only the property offences show a significant result, the other two types of offences do not. Also, confirmation of the hypothesis should be interpreted with caution; having committed at least one property crime namely also increases the predicted probability of a nonsex offence (B=0.649, z=7.77, p<.001). Thus, while hypothesis 2 can be confirmed thanks to the increase of predicted likelihood after a property offence, we cannot say anything about the difference in likelihood of a subsequent sex offence versus a subsequent nonsex offence. Having committed at least one property offence namely increases the likelihood of a subsequent sex offence as well as a subsequent nonsex offence versus no offence in year zero.

To be able to say a little more about the likelihood of subsequent offences, the actual predicted probabilities can be computed using STATA. Therefore, the predicted probability of a subsequent sex offence for a person who has committed at least one property offence (person A) is compared with a person who has not committed a property offence in the 5 preceding years (person B). The same is done for predicting the probability of a subsequent nonsex offence. The other predictors are held constant for this comparison (both persons are in trajectory group 2, have not committed a violent or damage offence, were 25 years old at year zero and were born in cohort 9 (thus between 1950 and 1954)). These predicted probabilities are computed using *F*, which is the cumulative distribution function of the standard normal. The calculations for finding the the predicted probabilities are shown in Table 7. The last step of each calculation is conducted using the *display normal* command in STATA, since these numbers are found using the cumulative distribution function (F).

Table 7

Predicted probability of a subsequent offence

	Subsequent sex offence	*Subsequent nonsex offence*
Person A	*F (*-0.559+ property *0.343 + age*-0.011 + cohort * -0.029)	*F (*-2.108 + property * 0.649 + age*-0.009 + cohort* 0.129)
	F (-0.559 + 1*0.343 + 25*-0.011 + 9*-0.029)	*F (*-2.108 + 1*0.649 + 25*-0.009 + 9*0.129)
	F (-0.752) = .22602553	*F* (-0.523) = .30048713
Person B	*F (*-0.559 + property *0.343 + age*-0.011 +cohort * -0.029)	*F (*-2.108 + property * 0.649 + age*-0.009 +cohort * 0.129)
	F (-0.559 + 0*0.343 + 25*-0.011 + 9*-0.029)	*F (*-2.108 + 0*0.649 + 25*-0.009 + 9*0.129)
	F (-1.095) = .13675832	*F* (-1.172) = .12059853

Thus, for a person who has committed at least one property offence in the 5 preceding years (Person A), the predicted probability of a subsequent sex offence is .23, while the predicted probability of a subsequent nonsex offence is .30. For a person who has not committed a property offence in the 5 preceding years (Person B), the predicted probability of a subsequent sex offence is .14, while the predicted probability of a subsequent nonsex offence is .12.

After having more insight in the actual predicted probabilities, it may still be said that the likelihood of a subsequent sex offence can be predicted by the type of crime. However, this is not to say that this prediction can be made more easily for sex offenders, nor that a subsequent sex offence is more likely than a subsequent nonsex offence after committing a property crime.

5. Conclusion and Discussion

After investigating the extent to which the first sex offence can be predicted, the following conclusions can be made. First of all, the criminal trajectories based on crime frequency up to the year of the first sex offence does not differ between sex offenders and age-matched nonsex offenders. This partly confirms the first hypothesis. The hypothesis can only be partly confirmed because trajectory group 5 constituted of more sex offenders than

nonsex offenders. However, this does not imply that we can not confirm the first hypothesis since there was no significance test conducted to prove that this difference is significant. In addition, the other 4 trajectory groups do have an even distribution of sex offenders and nonsex offenders. This implies that the occurrence of the first sex offence cannot be predicted based on crime frequency. However, this finding suggest that sex offenders are not so different from nonsex offenders, at least when looking at the period up to their first sex offence. That might imply that the popular view that sex offenders are distinct from nonsex offenders, which exists within society and among policy makers (Zimring, 2004), is not based on accurate information. However, implication should be regarded with caution since we have not looked at the period after the first sex offence, maybe sex offenders do become more different from nonsex offenders after the first sex offence. The present study only confirmed that sex offenders seem to be similar to nonsex offenders based on their crime frequency curve up to their first sex offence. Policy makers should keep this in mind, since treating sex offenders a different way than nonsex offenders, even though they show similar offending patterns in the first part of their criminal career, may lead to stigmatization or cumulative disadvantage and thus could be a reason why sex offenders may become more dangerous after their first sex offence.

The findings of the present study are thus in line with the majority of studies regarding the comparison between criminal careers of sex- and nonsex offenders (Jennings, Piquero, Zimring & Reingle, 2015). The difference between those studies and the present study is that the present study focused on the criminal careers of sex offenders prior to their first sex offence. The findings could suggest that crime frequency is brought about by general mechanisms that explain crime in general instead of crime specific theory. This study is thus in line with more general theories of crime, such as the self-control theory (Gottfredson & Hirschi, 1990), that do not state that crime frequency depends on the types of crimes.

However, this statement should be regarded with caution; the present study namely only looked at the period before the onset age of sexual offending, what happens throughout the rest of the criminal careers has not been studied.

The second research question was addressed by investigating the extent to which types of crimes can predict a subsequent sex offence. While controlling for crime frequency, it was found that committing at least one property offence in the 5 years under scrutiny, increased the predicted probability of committing a subsequent sex offence in year zero versus not committing any offence. This thus partly confirms the second hypothesis. The second hypothesis is also only partly confirmed since only property offending was found to significantly increase the predicted probability of a sex offence. Also, this confirmation does not go without saying that it does not say anything about comparing sex offenders with nonsex offenders; even though a property offence increases the predicted probability of a subsequent sex offence, it does also increase the predicted probability of a subsequent nonsex offence. Thus, also in the second part of the study sex offenders do not seem to be special when comparing them with nonsex offenders.

Having said that, the second hypothesis can still be partly confirmed because having committed a property offence does increase the predicted probability of a subsequent sex offence. The fact that crimes can be predicted using other types of crime is in line with previous research conducted by Soothill and colleagues (2000; 2002; 2004; 2008). However, this statement should also be regarded with caution since there are some limitations of the present study which are discussed later. Theories that relate to the idea that specific crime types predict other crime types are somewhat supported by the present study, such as the cumulative disadvantage theory (Sampson & Laub, 1997). On the other hand, one could say that property crime followed by a sex offence reflects the theory of cumulative disadvantage less than if violent crimes would be followed by a sex offence, since this latter sequence

seems to be a better representation of an escalation in seriousness. It is hard to make statements about this, since the present study did not look at specific crime types but more at general categories, which makes it hard to determine what sequence is really an escalation. This brings us to the limitations of the study.

As just mentioned, one limitation is that the present study did not study specific crimes, but more general categories of crime (violent/property/damage). This may have resulted in less useful results than for example the study of Soothill who studied more specific crimes (e.g. kidnapping predicts homicide) (2008). The categorisation was necessary since the dataset was not large enough to have enough cases for the regression analysis if specific crime types would be studied. However, now that the possibility of predicting a sex offence using other types of offences is studied, future research could use even larger data to specialise further by using specific types of crime in predicting a sex offence. This larger data could be reached by working with self-reports in addition to conviction data, since only a relatively small proportion of the population commits multiple types of crimes in their criminal career. It could also be that the registered data that was used in the present study was not a correct representation of the actual numbers of crimes that were committed, for example considering the dark number of sex offences which is discussed in the introduction. A better representation of the actual numbers could also be achieved using self-reports of victims and offenders.

Also, the results of the study do not state that we can predict a sex offence *specifically*, since other types of offences can be predicted by a property offence also and the crime frequency does not differ between sex offenders and nonsex offenders. This study only provided a start in attempting to predict a sex offence. Future research may use this starting point to investigate further what may predict a sex offence specifically. Due to lack of time, the present study did not study the impact of specific combinations or sequences of types of

crimes or patterns in the timing of offending on the predicted probability of a subsequent sex offence, which would also be useful to study in the future.

However, there are also some strengths of the present study. The specific research questions are unique in the sense that little to no research has been done so far regarding predicting a sex offence using the criminal history of sex offenders. Also, the dataset that was used for this unique research is a very large and well-known dataset with a lot of cases that are sex offenders. In addition, the dataset covers a very large period of time. Despite the limitations, the findings of the present study are still of great importance, especially as a starting point for future research in investigating the impact of patterns or timing of crimes and types of crimes on predicting a sex offence. Despite the fact that the present study can not necessarily say anything about the entire criminal career of sex offenders versus nonsex offenders, the present study did show that the criminal trajectories of sex offenders are not so different from nonsex offenders when you look at the period prior to the first sex offence. This is useful information, since policy is currently conducted with the idea that sex offenders are a distinct group of offenders (Boone, 2011), which is also the main idea in societies as a whole (Zimring, 2004). The results of the present study should be kept in mind when designing policy or future research projects so that sex offending will be prevented as much as possible.

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