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## Pick a number. Mapping recidivism measures and their consequences

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*Synøve Nygaard Andersen and  
Torbjørn Skardhamar*

## **Pick a number**

Mapping recidivism measures and their  
consequences



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## **Pick a number**

### Mapping recidivism measures and their consequences

**Abstract:**

Recidivism studies differ with respect to samples, definitions and follow-up periods. While it is recognized that such differences hamper comparability, there is little systematic knowledge about how recidivism figures are affected. We explore how deliberate changes in the following three parameters affect the reported recidivism levels: 1) sample definition, 2) measure of recidivism, and 3) length of follow up. We use administrative records from Norway which allow using total offender populations and combining information from several sources. Our results show that the proportion of reoffenders varies from 9 to 53 percent, depending on how, among whom and for how long recidivism is measured.

**Keywords:** Recidivism, Relapse to crime, Crime, Measuring

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**Discussion Papers**

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## Sammendrag

Å male tilbakefall til kriminalitet har vært en sentralt kriminologisk og rettspolitisk målsetning siden midten av 1800-tallet. Tilbakefall måles imidlertid på en rekke ulike måter, og man finner store variasjoner i både utvalgskriterier, mål på tilbakefall og tidsperspektiver (se for eksempel Armstrong og McNeill, 2012; Baumer, 1997 og Harris, Lockwood og Mengers, 2009). Hvordan tilbakefall måles kan imidlertid ha direkte konsekvenser for hvilke resultater man får, og dette kompliserer sammenligningen av resultater på tvers av studier med ulike design. Til tross for at dette er en velkjent problemstilling, vet vi lite om *hvordan* og i hvilken grad nivåene av tilbakefall faktisk påvirkes av forskerens utforming av forskningsdesignet. Målet med denne studien er derfor å undersøke hvordan tilbakefallsraten i Norge påvirkes av systematiske endringer i utvalgskriteriet, målet på tilbakefall og oppfølgingsperiodens varighet. Vi følger tre utvalg av lovbyggere i opp til fire år, og registrerer tilbakefall basert på tre ulike mål.

De tre utvalgene består av alle personer med godkjent oppholdstillatelse i Norge som ble siktet, dømt eller løslatt fra (ubetinget) fengsel for en forbrytelse i 2005. Informasjon om lovbruddene hentes fra dataene over etterforskede lovbrudd, dataene over straffereaksjoner og dataene over fengslinger. Informasjon om dødsfall og utflyttinger i oppfølgingsperioden hentes fra FD-Trygd, og informasjon om fengslinger i observasjonsperioden fra fengslingsdataene. Vi benytter denne informasjonen i en diskret-tids forløpsmodell, som estimerer tiden (i måneder) fra siktelsen, dommen eller løslatelsen i 2005 til et nytt lovbrudd blir begått. Vi vektet hver personmåned etter andelen av måneden som ikke tilbringes i fengsel, for å ta hensyn til at muligheten for tilbakefall reduseres betraktelig når vedkommende er fengslet. Vi inkluderer ingen kontrollvariabler, ettersom hensikten med analysen er å beskrive den *faktiske* andelen i hvert utvalg som begår et nytt lovbrudd innen en gitt tid.

Samlet sett viser resultatene at tilbakefallsraten varierer fra 9 til 53 prosent, avhengig av hvordan, blant hvem og hvor lenge tilbakefallet måles. Vi gjensker noen velkjente mønstre fra tidligere studier; at tilbakefallsraten er høyest tidlig i oppfølgingsperioden; at andelen med tilbakefall innen et gitt utvalg synker når vi går fra mindre til mer strenge tilbakefallsmål (f.eks. fra gjensiktelse til gjeninnsettelse); og at risikoen for tilbakefall er høyest tidlig i oppfølgingsperioden (j.f. Armstrong og McNeill, 2012; Bowles og Florackis, 2007; Langan og Levin, 2002; O'Donnell m.fl., 2008; Skardhamar og Telle, 2012). Videre finner vi at den tidsmessige utviklingen i tilbakefall varierer både med utvalg og tilbakefallsmål. Samlet sett har utvalget av domte og fengslede – samt målene basert på ny dom og ny fengsling – de likeste resultatene. Våre funn støtter tidligere anbefalinger om at oppfølgingsperioden er minst to år, og viser i tillegg at en lenger oppfølgingsperiode er spesielt viktig når man benytter et strengt tilbakefallsmål og et mindre strengt utvalgskriterium.

## Introduction

The measuring and reporting of recidivism dates back to the 19<sup>th</sup> century (Radzinowicz, 1945), with purposes such as evaluation of system and program effectiveness, prediction of future crime levels, and developments and improvements in the criminal justice system (Farrington and Davies, 2007; Harris, Lockwood and Mengers, 2009; Harris et al., 2011). In spite of the importance of ensuring comparability between recidivism studies and of recidivism research being an established field of study, there is no widespread consistency in definitions, measurements or reporting practices (c.f. Armstrong and McNeill, 2012; Blumstein and Larson, 1971; Harris et al., 2009; Harris et al., 2011; Wartna et al., 2010). Most commonly, recidivism is defined as a falling back or relapse into prior criminal behavior by a person that is known to have committed at least one previous offense (c.f. Blumstein and Larson, 1971:124; Maltz, 1984:84). This requires three important components to be defined in any recidivism study: 1) *Who* is to be regarded as a (previous) offender; 2) *What* constitutes a (new) offense; and 3) *By when* should a new offense occur.

Recidivism studies most commonly consist of a sample of arrested persons (e.g. Ahven, Salla and Vahtrus., 2010; Wartna et al., 2008), convicted persons (e.g. Wartna et al., 2008, 2011) or persons released from prison (e.g. Ahven et al., 2010; Baumer, 1997; Beck and Shipley, 1989; Bowles and Florackis, 2007; Langan and Levin, 2002; O'Donnell et al., 2008; Wartna et al., 2008, 2011). The sample type may determine the age structure and whether it is a high-risk group or a low-risk group. Furthermore, the reoffense is most commonly defined as a new arrest (e.g. Ahven et al., 2010; Beck and Shipley, 1989; Langan and Levin, 2002), a new conviction (e.g. Baumer, 1997; Beck and Shipley, 1989; Bowles and Florackis, 2007; Wartna et al., 2008, 2011) or a new imprisonment (e.g. Baumer, 1997; Harris et al., 2009, 2011; O'Donnell et al., 2008).<sup>1</sup> These definitions of recidivism inherently lead to different results within a given sample, since the less serious offenders are excluded as we move towards the back-end<sup>2</sup> of the criminal justice system (i.e. imprisonment). Finally, the follow-up time in most studies varies from one (e.g. Ahven et al., 2010) to three years (e.g. Beck and Shipley, 1989; Langan and Levin, 2002; Skardhamar and Telle, 2009, 2012; Wartna et al., 2008). Two years is a common recommendation (e.g. Armstrong and McNeill, 2012; Graunbøl et al., 2010). A longer exposure time would obviously lead to a higher proportion of reoffenders, no matter how recidivism is measured.

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<sup>1</sup> See Maltz (1984) for a thorough review of the occurrence of different recidivism measures.

<sup>2</sup> We refer to different samples and measures of recidivism as “front-end” and “back-end”, with the former referring to early contact points between the individual and the criminal justice system (e.g. arrests) and the latter referring to later points of contact (e.g. incarcerations).

It is both trivial and widely acknowledged that these characteristics of the research design have implications for recidivism figures. However, few systematic studies have been conducted on *how* their respective operationalization actually impacts the results. A better understanding of the relationship between the various aspects of the research design and the encountered levels of recidivism is important for numerous reasons. The goal of this analysis is hence to utilize the flexibility of Norwegian registry data to examine more precisely how recidivism rates are affected by changes in the sample criterion, the measure of recidivism, and the duration of follow-up. The registry data allows linking information across multiple registries and thus to create a “fixed” setting where some parts of the design can be changed and subsequent changes in recidivism findings can be thoroughly examined.

## **The sample, the measure, and the follow-up period: Common-practices and previous findings**

Defining the sample to be examined, the measure to be applied, and the time period when the sample is followed up are among the main questions in the design of any recidivism study. A closer look at the literature establishes that numerous combinations of these design characteristics have been applied, and this diversity remains one of the greatest challenges in current comparative recidivism research (c.f. Armstrong and McNeil, 2012; Farrington and Davies, 2007; Harris et al., 2009, 2011; Wartna et al., 2010). The literature on recidivism is primarily confined to a few highly industrialized Western nations, and thorough reviews of existing research are already available (see e.g. Armstrong and McNeill, 2012; Baumer, 1997; Harris et al., 2009; O’Donnell et al., 2007). In the following we will discuss current practices regarding each of these design characteristics and present trends in previous research findings where these are available. Although the main purpose of the study is methodological, and the absolute numbers therefore are of secondary importance, this will provide the reader with a comparative backdrop for interpreting the results.

### **The sample**

As most recidivism studies are based on official records (Harris et al., 2009; O’Donnell et al., 2007), it is often an individual’s contact with the criminal justice system that identifies the offense used to define the sample (the “index crime”). Common approaches are to include everyone released from prison (or a youth correctional facility) in a given year, everyone arrested in a given year or everyone convicted in a given year. The kind of sample is important as the more back-end sample might be more selected on criminal characteristics than the front-end sample. In addition, there might be



differences in population structure (age and sex) and selection on other social characteristics such as educational level etc.

Out of the three, we find that released prison inmates represent the far most studied population in current recidivism research (e.g. Armstrong and McNeill, 2012; O'Donnell et al., 2008; Wartna et al., 2010). Convicted offenders also occur rather frequently (e.g. Graunbøl et al., 2010; Wartna et al., 2008, 2011), while studies of arrested offenders are more rare. This pattern is probably due to both the availability of prison data and the importance of and attention paid to serious crimes and criminals. We find that implications of the sample criteria for recidivism figures have passed more unnoticed in the literature than, for example, the impact of the recidivism measure and length of follow-up period (see e.g. Harris et al., 2009). This may be a result of few studies actually including a sufficient number of samples whereby this can be assessed. Ahven et al.'s (2010) Estonian study is an exception, and the findings show that the proportion of reoffenders increase from 24 to 40 percent when they use a sample of imprisoned rather than convicted offenders.

A more common approach than the inclusion of multiple samples is to break down samples of inmates or convicted offenders by type or severity of the initial crime or sanction (i.e. the index crime). For example, in their review, Armstrong and McNeill (2012:37) grouped offenders by sanction type and find that the proportion of reoffenders is higher among those who receive prison sentences than among those who receive community sentences. This holds true for all the countries they reviewed (Scotland, England and Wales, Ireland, Northern Ireland, Norway, and New Zealand). Similarly, Haslund (2003) finds that the proportion of reoffenders increase from 50 to 62 percent if one examines a sample sanctioned to unconditional prison sentences rather than a sample comprising all sanctioned offenders. For similar findings, see Statistics Denmark (2012), Graunbøl et al. (2010), and Wartna et al. (2011).

## **The measure**

To define and operationalize the outcome variable, i.e. the measure of recidivism, we need a clear understanding of what is to be considered as recidivism. As in the definition of the sample, it is often a registered contact – and here a *recontact* – between an individual and a certain part of the criminal justice system that serves this purpose. Maltz (1984) found nine different decision points that served the purpose of recidivism measure in his review of over 90 recidivism studies.

Most commonly constructed into a simple dichotomy of reoffense/no reoffense,<sup>3</sup> rearrests, reconvictions, and reimprisonments are among the most frequent measures in current studies (c.f. Armstrong and McNeill, 2012; Harris et al., 2009; Holley and Ensley, 2003; Lyman and LoBuglio, 2006). What we can call “front-end” measures inherently produce higher recidivism rates in a given sample than do “back-end” measures, since less serious offenders are excluded as we move through the system. Hence, these measures are inherently incomparable (cf. Harris et al., 2011:7).

When reviewing the literature on recidivism with particular attention on the applied measure, it seems that variations in reported levels can be found along two dimensions: *within* a given measure, for instance between studies that all apply a measure based on arrests; and *between* various measures, for instance between studies in which some apply a measure of arrests and some a measure of convictions.

As the most front-end of the more common measures of recidivism, arrests may be expected to yield the highest proportion of reoffenders in a given sample. Absolute levels may vary considerably, although most seem to fall within a typical range of 40–70 percent (c.f. Snyder and Sickmund, 2006). For instance, Langan and Levin (2002) found that 44 percent of the 1994 prison cohort in the US was rearrested for a new offense within one year of release. This proportion increased to 59 percent after two years, and 68 after three years.<sup>4</sup> It is important to note that the meaning of the word *arrest* may differ considerably between different studies and legal contexts; for instance, Ahven et al. (2010:158-9) define rearrests as an interrogation of a person as a suspect, while Skardhamar and Telle (2012:630) use a rearrest measure based on cases solved by the police.<sup>5</sup>

A more common<sup>6</sup> measure of recidivism, recidivism rates measured as reconvictions, falls within a typical range of 40 to 60 percent. For instance, Armstrong and McNeill (2012:19) report two-year reconviction rates of between 42 (Scotland) and 62 (New Zealand) percent in their national reviews, and Wartna et al. (2009) shows two-year reconviction rates of 29, 45, and 55 percent for the Netherlands, Scotland, and England and Wales, respectively. Similar numbers are found by, for example, Bowles and Florackis (2007) (58 percent after two years) and Harris et al., (2009) (55 percent after one year, for both juvenile and adult offenders). If we apply numerous measures to one

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<sup>3</sup> See Harris (2009:12-13) and Farrington and Davies (2007:6–9) for examples of other measures of recidivism.

<sup>4</sup> For the similarly executed study of the 1983 cohort, Beck and Shipley (1989) found results that were about 5 percentage points lower at all measuring points.

<sup>5</sup> See the second paragraph in the following section on empirical strategy for a more thorough review of arrest data in Norway.

<sup>6</sup> Rearrest is primarily used as a recidivism measure in North American studies, and then primarily in studies of juvenile correctional facilities (see e.g. Harris et al., (2011) for a review).

sample, we may expect fewer reoffenders at a given point in time if we apply the measure of reconvictions rather than the measure of rearrests.

As the most stringent or most back-end of the recidivism measures discussed here, reimprisonments can be expected to yield the lowest proportion of reoffenders within a given sample at a given point in time. A typical range of reoffending measured via reimprisonment varies from 30 to 50 percent in national studies (O'Donnell et al., 2008), and according to Armstrong and McNeill (2012), this also seems to hold in more recent research. For instance, O'Donnell et al.'s (2008) analysis of the 2001–2004 prison release cohorts in Ireland shows that 39 percent is reimprisoned within two years, and Nadesu (2009a, 2009b) finds the corresponding figure for the 2002–2003 prison cohort in New Zealand to be 37 percent. Skardhamar and Telle (2012) examine reimprisonments among the 2003 prison release cohort in Norway and find that 27 percent is reincarcerated within a three-year time frame.

### **The follow-up period**

Finally, the duration of follow-up defines how long a given sample is followed. This has direct implications for the expected results; longer observation time yields higher proportions of reoffenders than do shorter ones. To prolong the follow-up period is in most cases rather resource-demanding, and a key question is therefore what time period is *sufficient* to produce a clear picture of intervention impacts (Harris et al., 2009:11). A widely applied and recommended duration of follow-up in current recidivism research is two years (e.g. Armstrong and McNeill, 2012; Farrington and Davies, 2007; Graunbøl et al., 2010). Another important question is whether one should consider “time at risk” or “whole time”; in other words whether one should only include the proportion of a follow-up period that is spent out of prison, institutions, etc., or the whole time since the last offense. Farrington and Davies (2007) argue that prison spells should be excluded from the follow-up period completely, although some types of crimes (such as those related to violence and drugs) might indeed also take place while in prison (see for example Gillespie, 2005; Wolff et al., 2007).

As already mentioned, the increasing proportion of reoffenders following from an extension of the follow-up period is widely documented. For instance, Wartna et al. (2010) show that the proportion of reoffenders in their Dutch sample of previous inmates is 43 percent after one year, 56 percent after two years, and 62 percent after three years. After eight years, 74 percent had been reconvicted of a new crime. Apart from demonstrating the gradual increase over time within samples, these findings also illustrate that the intensity in reoffending is highest shortly after the follow-up period has begun. This

is a common finding in recidivism studies, and Bowles and Florackis (2007:368) find that 75 percent of the offenders in their sample who were reconvicted within two years of release were reconvicted within the first 12 months. Similar patterns have been found by, for example, Allen and Shipley (1989), Armstrong and McNeill (2012) and Skardhamar and Telle (2012). Hence, absolute levels and annual variations vary greatly between studies, but it is clear that the absolute levels of recidivism increase at a higher pace early in the follow-up period. This indicates that the risk of erroneously comparing results is highest when follow-up periods are disparate and rather short.

### **Previous findings: General trends**

In sum, current recidivism studies reflect diversity and variation in both research design and results. Some reference points may still be drawn. First, the most common sample criterion is based on prison releases. Although not thoroughly examined, it seems that more serious index crimes or sanctions affect the risk profile of the sample in ways that increase the proportion of reoffenders. The most apparent distinction can be drawn between offenders sentenced to prison and those receiving milder sentences, with the first group at higher risk of reoffending.

Second, the most common measures of recidivism are the dichotomous outcomes of at least one arrest, one conviction or one imprisonment taking place during the follow-up period. Findings vary greatly within each measure, but a typical range seems to be between 40 and 70 percent for rearrests, 40 and 60 percent for reconvictions, and 30 and 50 percent for reimprisonments (cf. Armstrong and McNeill, 2012; Bowles and Florackis, 2007; Langan and Levin, 2002; O'Donnell et al., 2008). When numerous measures are applied to the same sample, more back-end measures yield lower proportions of reoffenders than do front-end measures.

Third, the follow-up period in most studies is between one and three years. A common practice and recommendation is to apply a follow-up period of two years. The intensity of reoffending is highest shortly after the previous crime, and two years allow for a substantial proportion of reoffenses to have taken place.

With these reference points, we now move on to describing the data and statistical methods that form the basis of our analysis. The goal is, as previously described, to create a “fixed” setting in which either the sample, the measure or the follow-up period is deliberately changed and ensuing changes in recidivism rates are observed. By doing so, we hope to obtain a clearer picture of the extent to which each component of the research design leads to variations in levels of recidivism.

## Empirical strategy

Following the literature, we define ‘recidivism’ as the commitment of an offense by a person known to previously have committed at least one other offense (c.f. Blumstein and Larson, 1971:124; Maltz, 1984:84). We build our analysis around three points of contact between the individual and the criminal justice system: the *arrest*, the *conviction*, and the *imprisonment*. These contact points serve as both sample criteria and measures of recidivism.

In the Norwegian crime statistics, data on arrests *per se*<sup>7</sup> are not available. The most front-end source of information is the data on so-called *charged* offenders, which comprise individuals considered to be the prime suspect at the end of a police investigation.<sup>8</sup> We choose to keep the label *arrest* throughout this article so as to maintain the close relationship between this contact point and the point of arrests that is most commonly found in the international literature. At the same time, it is important to note that the measures are not directly comparable. In simplified terms, a charge can be regarded as a strict measure of arrest (i.e. it occurs later in the penal process).

To be *convicted* means that the offender has been found guilty and has been convicted in court of a given crime. We do not include offenses that are sanctioned by the prosecution authorities outside the courts.<sup>9</sup> To be *imprisoned* means that the offender is sentenced to unconditional prison or preventive detention<sup>10</sup> for the crime committed. As we wish to establish this as a more serious point of contact, we do not include incarcerations that are due to custody, parole violations or incapacity to pay fines. To allow for new crimes committed, the term *imprisoned* always refers to those who are *released* from prison at the beginning of the follow-up period.

## Data sources

All data are based on individual-level Norwegian administrative records from records kept by the police, the courts, and the prosecution authorities. These data are used to produce official crime statistics and are also available for research purposes from Statistics Norway. All persons residing in Norway are given a unique personal identification number<sup>11</sup> which is used in these statistical systems, and the same persons can therefore easily be traced both across each of these registers as well as over time, providing great flexibility of research design. It also allows linking information at the individual-level to the population registry and other registries available at Statistics Norway. We only include

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<sup>7</sup> I.e. liberty deprivation.

<sup>8</sup> Contrary to the more common use of the term *charge*, formal charges that are raised and dropped during the investigation are not included.

<sup>9</sup> Most commonly misdemeanours sanctioned by fines or conflict resolution.

<sup>10</sup> Preventive detention sentence is used for offenders considered to be dangerous to the public.

<sup>11</sup> Assigned to all Norwegian citizens as well as to immigrants with permanent residence permits.

felonies, so less serious misdemeanors are left out. This is primarily to exclude traffic offenders; a low-risk offender group that is both frequently and (unusually) seriously sanctioned in Norway (see Graunbøl et al., 2010). By doing so, we hope to improve comparability between our study and studies from other countries. We restrict the analysis to persons born in Norway or immigrants with a permanent residence permit. This ensures that the sample can be reliably identified across registers and avoid the issue of foreigners being deported as a consequence of the crime committed.

Data on crime is retrieved from three different databases at Statistics Norway: data on arrests (based on police data on solved cases), data on criminal sanctions, and data on imprisonments (both based on the Norwegian central penal register).<sup>12</sup> These data sources are used to define the three samples we examine. We then add the data on arrests to *all* three sample files to identify new crimes and to create the three outcome variables. The data on arrests (as opposed to the sanction data and the prison data) include the date of (re)offense, and this enables an accurate timing of reoffending in which we exclude both false positives<sup>13</sup> and false negatives.<sup>14</sup> To be able to use the date of reoffense and create more back-end outcome variables, we use a retrospectively updated decision code that tells us the final legal decision for a given crime when the case has passed through the criminal justice system. We can therefore identify the commitment of an offense that *eventually* will lead to a conviction in court or an unconditional prison sentence at the same time as we can use the date of an offense to determine the timing of reoffending.

In addition to this information on committed crimes, the data on imprisonments provide information on prison spells during the follow-up period. This information is included to account for the reduced risk of reoffending that follows an incarceration. Finally, information on right-censoring events (death and emigration) is retrieved from the population registry.

## Samples

The samples consist of all offenders with a Norwegian personal identification number who are either arrested (N=31 842), convicted (N=14 466) or released from prison (N=5503) for a felony offense during 2005.<sup>15</sup> The 2005 cohort is chosen primarily to allow for a sufficiently long follow-up period, as 2008 was the latest available annual data in which all cases were fully decided and information on offending date and decision code were updated at the time of starting the analyses. Some individuals

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<sup>12</sup> See Statistics Norway (2013a, b, c) for more thorough information on the origin and content of these data sources.

<sup>13</sup> New arrests, convictions or imprisonments that are due to an offense committed *before* the index crime.

<sup>14</sup> Crimes that are *committed* during the follow-up but that remain unaccounted for due to time gaps between the commitment, the reporting, and the sanctioning of an offense.

<sup>15</sup> The samples are referred to as the arrested sample, the convicted sample, and the imprisoned sample. The samples are smaller than in official registers (e.g. statistics of released persons from prison) because of selection criteria discussed above.

may be present in more than one sample, although not necessarily for the same crime. The delay between each stage in the criminal justice system (and hence the data sources) implies that the three samples do not overlap perfectly.

As discussed above, the samples might differ on a number of characteristics. Table 1 shows the characteristics of the offenders in each sample on what type of crime lead to the arrest, conviction and (completed) prison sentence in 2005, average age and proportion of females. In addition, to shed light on social selection in each sample, we include information on educational level and parents' educational level. The reported characteristics are all known to affect the risk of reoffending (c.f. Armstrong and McNeill, 2012; Bowles and Florackis, 2007; Graunbøl et al., 2010; O'Donnell et al., 2008) and, thus, the risk profile in each sample. In cases where the arrest, conviction or completed prison sentence is based on numerous offenses, the felony with the maximum penalty is reported here.

**Table 1: Descriptive statistics of background characteristics and crime type (main offense) in the three samples. Percentages**

	<b>Arrested</b>	<b>Convicted</b>	<b>Imprisoned</b>
<b>Mean age<sup>a</sup> (S.D.)</b>	29.9 (11.1)	29.8 (10.5)	32.35 (10.2)
<b>Gender</b>			
Male	84.9	87.8	93.4
Female	15.1	12.2	6.6
<b>Educational level<sup>a</sup></b>			
Lower secondary school or less (9 years)	42.0	44.7	48.5
Upper secondary school (12 years)	3.9	3.5	3.3
Higher education (15+ years)	0.9	0.7	0.8
Unknown	53.2	51.1	47.4
<b>Social background<sup>b</sup></b>			
Lower secondary school or less (9 years)	28.0	29.6	30.3
Upper secondary school (12 years)	46.7	46.9	46.9
Higher education (15+ years)	14.7	13.2	12.3
Unknown	10.6	10.3	10.5
<b>Crime type (main offense)</b>			
Economic (0)	6.0	8.5	9.7
Gain/property (1)	23.7	35.1	33.2
Violent (2)	21.6	23.7	29.1
Sexual (3)	2.7	3.4	4.5
Drug (4)	34.5	22.6	18.9
Damage/destruction (5)	4.5	1.8	0.8
Environment (6)	0.1	0.0	0.0
Other (9)	7.0	4.9	3.8
<b>N</b>	<b>31 842</b>	<b>14 466</b>	<b>5503</b>

<sup>a</sup> Measured at the beginning of the follow-up period.

<sup>b</sup> Parents' highest completed educational level at age 16.

In general, the similarities between the three samples are more evident than the differences. All samples have a mean age of around 30 years at the beginning of the follow-up period, most offenders are male, and most come from families with upper secondary/high school education. The mean age does, however, increase somewhat as the sample criterion becomes more serious, and the diversification in age is highest in the arrested sample. This is a pattern we recognize from previous statistics, where the prison population is older and more homogenous in age than the population of arrested offenders (Thorsen, Lid and Stene, 2010). We also see that, although women constitute a minority, the proportion of female offenders is highest in the sample of arrested offenders and lowest in the sample of released prison inmates. This indicates that the proportion of women decreases as the sample criterion becomes more serious.

Regarding the types of crimes committed, we see that crimes related to violence, drugs, and gain/property are the most common crimes in all samples. The proportion of violent offenders is higher in the imprisoned sample than in the other two samples, while the proportion of drug offenders is highest in the arrested sample. Gain/property offenders are more common in the convicted sample and the imprisoned sample. Environmental and sexual crimes are relatively rare in all samples, as are crimes involving damage and “other” crimes.<sup>16</sup>

## Statistical model

To assess the development in reoffending over time, we estimate a discrete time hazard model (Allison, 1995) taking the form

$$\log \frac{p}{1-p} = (\alpha + \beta_1 \text{TIME})$$

where  $p$  is the probability that individual  $i$  relapses to crime. Relapse to crime is measured by three dichotomous outcome variables, each valued 1 if a reoffense has taken place and 0 otherwise. A *rearrest* occurs if a person commits a new felony of which he or she is eventually arrested. A *reconviction* takes place if a committed offense eventually leads to a conviction in court, and a *reimprisonment* if it eventually leads to an unconditional prison sentence. *Time* is entered as a vector of one-month dummies, indicating the number of months from the onset of the follow-up period until the new crime is *committed*. The maximum length of follow-up in our data is 4 years (48 months), and the variable hence has values ranging from 1 to 48. The estimated model does not include other covariates, as we wish to explore the *de facto* recidivism patterns in the three samples. It is nonetheless

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<sup>16</sup> Traffic crimes are frequently sanctioned in Norway, but as these are categorized as misdemeanours they are not included here.



important to remember that any observed variations between samples may be due to their respective demographic composition, and that any disparities therefore may change if control variables were included. To account for prison spells during the follow-up period, the observations are weighted according to “street time,” i.e. the proportion of each month the person is not in prison.<sup>17</sup>

The discrete-time hazard models provides us with estimates which, through a simple recalculation,<sup>18</sup> show the *conditional* probability of relapse, i.e. that a relapse takes place at time  $t$  given that it has not occurred earlier in the follow-up period. These conditional probabilities are shown in Figures 1.2, 2.2 and 3.2 below. To give the results a more intuitive interpretation, we convert<sup>19</sup> these conditional probabilities into *cumulative* probabilities. These show the cumulative (i.e. total) probability of reoffending in each sample after a given number of months, or in other words, the proportion of each sample that has recidivated. These figures are presented in Figures 1.1, 2.1 and 3.1 below. We can obtain an intuitive understanding of the relationship between the two figures by perceiving the conditional probability as the *gradient* in the cumulative curve at time  $t$ .

## Results

In the following section we present the temporal development in the recidivism probability in each sample after a given time in the follow-up period. We present the results in two figures for each sample; the left figure shows the cumulative recidivism probability and the right figure shows the conditional recidivism probability after a given number of months. All three measures of recidivism are included in each figure, represented by the same labeling throughout. The two types of figures consistently apply the same scale on the y-axis; 0–0.6 for the cumulative rates and 0–0.07 for the conditional rates.

Starting with the arrested sample, Figures 1.1 and 1.2 show the cumulative and conditional recidivism probabilities between 1 and 48 months (at risk) after the date of initial arrest. The cumulative rates in Figure 1.1 show the total proportion of the sample that recidivated after a given number of months. Following the upper, solid line, we see that 29 percent committed a rearrest offense during the first year, while 49 percent did so at the end of the four-year-long follow-up period. The middle, dashed

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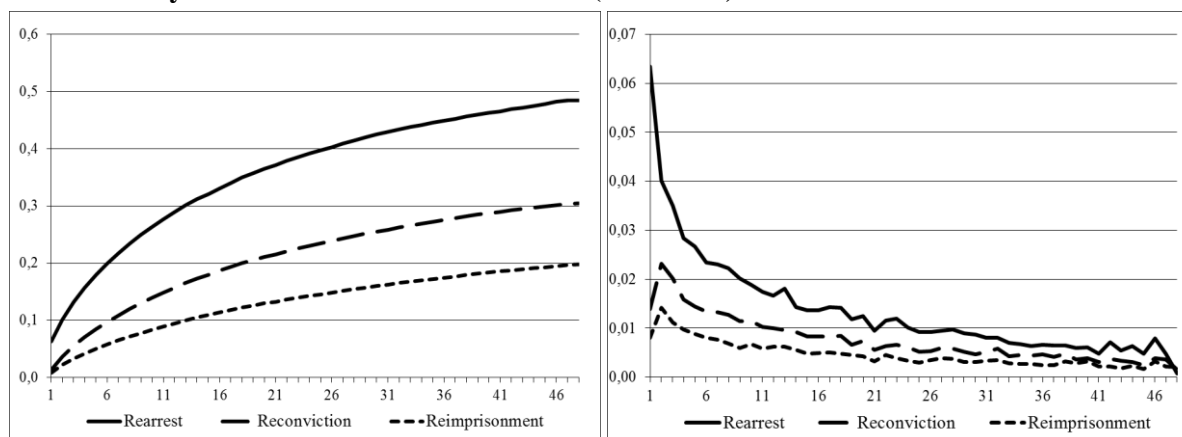
<sup>17</sup> Here we include all prison spells, including custody, etc. The weight varies between 0 and 1; 0 if 100 percent of a given month is spent in prison and the person-month/observation should not contribute to the analysis at all; 0.5 if 50 percent of the month is spent in prison, 1 if 0 percent of the month is spent in prison, etc. The time variable hence refers to the time “at risk”, rather than “all the time” (c.f. Wartna et al., 2010:4). Results with and without weights are very similar, and can be seen in Appendix A.

<sup>18</sup>  $Con_t = e^{L_t} / (1 + e^{L_t})$ , where  $L_t = \log(p/1-p)$ , the logit of relapse occurring at time  $t$ .

<sup>19</sup>  $Cum_t = 1 - S_t = 1 - (S_{t-1} * (1 - Con_t))$ , where  $S_t$  is the survival probability at time  $t$ .

line shows the cumulative recidivism rate when reoffending is measured as a reconviction,<sup>20</sup> and by applying this measure we get a one- and four-year recidivism rate of 16 and 31 percent respectively. Finally, the lower, dotted line shows the cumulative recidivism rate when recidivism is measured as an unconditional prison sentence. Nine percent of the arrested sample committed such an offense during the first year, and 20 percent did so at the end of the follow-up period.

**Figures 1.1 and 1.2: Cumulative and conditional recidivism probabilities in the arrested sample, by measure of recidivism and time (in months) since initial date of arrest. N=31 842**



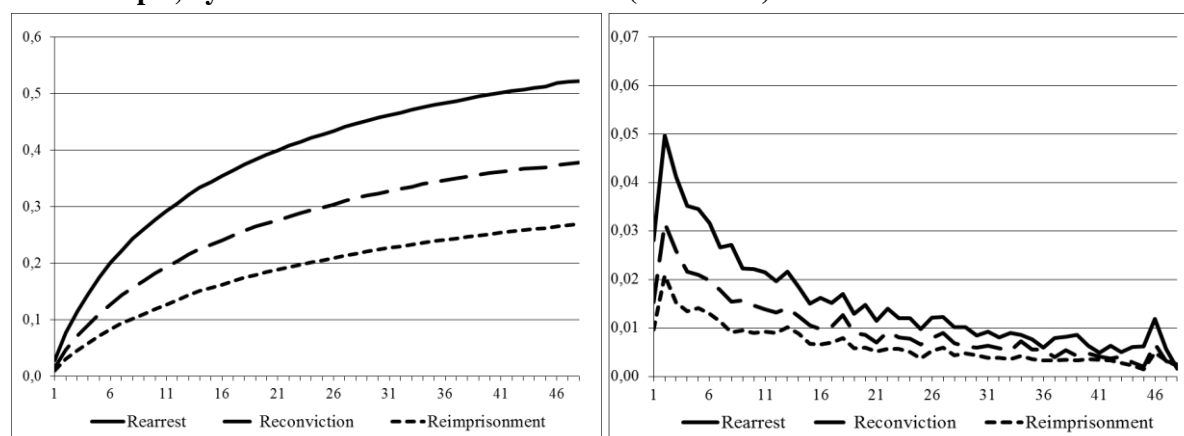
These figures illustrate three important patterns in reoffending. First, we see the inevitable trend of a decreasing number and proportion of reoffenders as we move from front-end to back-end measures within a sample. Second, we see that the intensity in reoffending is strongest shortly after the initial arrest even though individuals in a small proportion of the sample commit their first new crime several years later. Third, it seems that the two most back-end measures (reconviction and reimprisonment) yield more similar results than the two most front-end measures (rearrest and reconviction) in terms of both absolute levels and cumulative development in reoffending over time.

Moving on to the conditional recidivism rates in Figure 1.2, these show us the rate of reoffending for a given individual after a given number of months – given that no reoffense has been committed by that same individual earlier in the follow-up period. Following the measure of rearrest (still identified by the solid line), we can clearly see how the risk of reoffending is highest immediately after initial arrest. The conditional recidivism rate for this measure drops from 6.3 percent for the first month to 2.3 percent for the sixth month. The likelihood of reoffending decreases further and is less than one percent from the twenty-fifth month and onwards. The middle, dashed line shows that the probability

<sup>20</sup> Please note that the prefix *re-* in the two most back-end measures do not necessarily apply for all offenders in the arrested sample and the convicted sample. Nonetheless, we maintain this measure prefix throughout to distinguish clearly between the index offense and the reoffending offense.

of committing a reconvicting offense is highest (2.3 percent) during the second month, before decreasing first rather quickly and then more slowly after about 6 months. Finally, the pattern for reoffending measured as a reimprisonment (still identified by the dotted line) is rather similar to what we see for the measure of reconvictions. The risk peaks at 1.4 percent during the second month, and is less than one percent from the fourth month and onwards. These patterns reflect the steep increase and gradual leveling out of the curves in Figure 1.1, and can be ascribed to the fact that as time passes, our sample comprises an increasingly more law-abiding group of offenders that are less likely to reoffend.

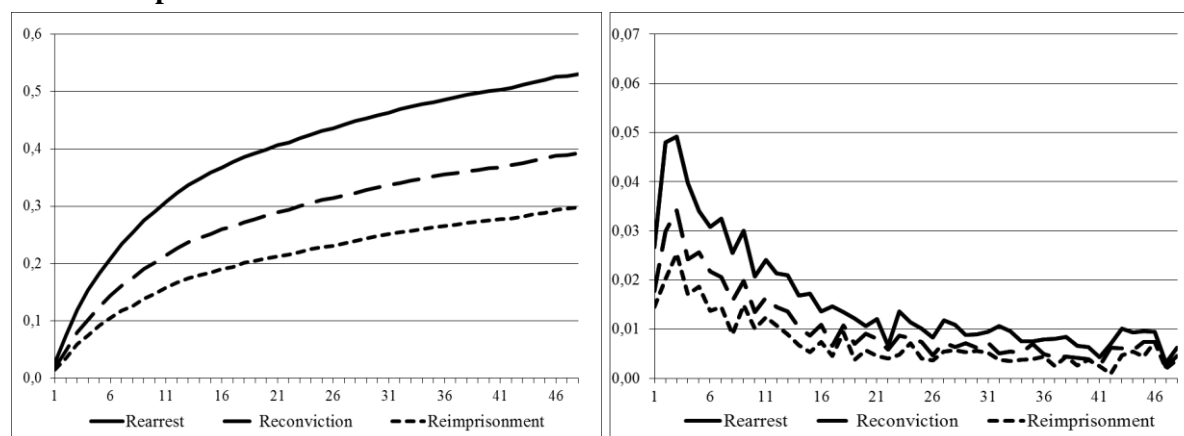
**Figures 2.1 and 2.2: Cumulative and conditional recidivism probabilities in the convicted sample, by measure of recidivism and time (in months) since initial conviction. N=14 466**



Moving on to the convicted sample, Figures 2.1 and 2.2 show the cumulative and conditional recidivism probabilities between 1 and 48 months (at risk) after the date of the initial conviction. Starting with Figure 2.1, this shows that the total proportion of reoffenders increases from 31 percent after one year to 52 percent after four years when we apply the measure of rearrest. The measure of reconvictions yields a proportion of reoffenders that increases from 20 percent after one year to 38 percent after four years, and the measure of reimprisonments increases from 13 to 27 percent. The gap between the levels for the measure of reconvictions and rearrests are slightly less evident here than for those we saw in the arrested sample, but the two most back-end measures still seem to yield slightly more similar results than the two most front-end measures.

Moving on to Figure 2.2, this shows that the conditional recidivism rate peaks during the second month for all measures. The rates are 5 percent for an offense leading to a new arrest, 3.2 percent for an offense leading to a new conviction, and 2.1 percent for an offense leading to a prison sentence. These probabilities all decrease by about 50 percent during the next 5–7 months before decreasing more gradually and unstably for the remainder of the follow-up period. Levels are slightly higher than we saw in the arrested sample, resulting in higher overall levels in Figure 2.1.

**Figures 3.1 and 3.2: Cumulative and conditional recidivism probabilities in the imprisoned sample, by measure of recidivism and time (in months) since the initial release from prison. N=5503**



Finally, in assessing the imprisoned sample, Figures 3.1 and 3.2 show the cumulative and conditional recidivism probabilities between 1 and 48 months (at risk) after the date of prison release. The patterns are very similar to those of the convicted sample apart from slightly higher levels. Figure 3.1 shows that during the first year, 32 percent of the samples committed an offense for which they were eventually rearrested. After four years, this proportion of reoffenders increased to 53 percent. Twenty-three percent of offenders committed an offense during the first year for which they were eventually reconvicted, and 17 percent committed an offense that led to a new prison sentence. After four years, the proportions of reconvicted and reimprisoned are 40 and 31 percent respectively. Absolute levels of reoffending are hence highest in this sample, although they approximate those in the convicted sample as time passes.

Figure 3.2 shows that the conditionally probability of relapse is highest during the third month for all measures: 5.0, 3.4, and 2.5 percent respectively for rearrest, reconviction, and reimprisonment. The probability decreases rather steadily until about 20 months have passed, after which we see a smaller, more gradual decline. This indicates that both the level of reoffending and the persistence in reoffending during the first part of the follow-up period are higher in the imprisoned sample than in the arrested and convicted samples.

### **Samples, measures and follow-up periods: General trends**

We will now summarize the results in Figures 1.1 to 3.2 by providing point estimates for each 12 month duration, and paying particular attention to how they demonstrate the consequences of the sample criteria, the measure of recidivism, and the duration of follow-up on the recidivism results. We will primarily focus on the cumulative curves, as these have a more intuitive interpretation. The results

from Figures 1.1, 2.1 and 3.1 are summarized in Table 2. Each column provide the total fraction of each sample that relapsed into crime after a given number of years, as well as the proportion of the *rearrested* in each sample that also were reconvicted or imprisoned (for the same or for various offenses). These numbers are written in the parentheses. For example, for the arrest-sample, 29 percent were rearrested and 16 percent were reconvicted after one year. Those reconvicted is thus 54 percent of those rearrested. The discussion will be arranged in three sections, one for each characteristic of the research design.

**Table 2: Summary of cumulative recidivism rates. Percentages**

	1 year	2 years	3 years	4 years
<b>Arrested</b>				
Rearrest	28.9	39.2	44.9	48.5
Reconvicted (%) <sup>a</sup>	15.7 (54)	23.0 (59)	27.6 (62)	30.5 (63)
Reimprisoned (%) <sup>b</sup>	9.4 (33)	14.3 (37)	17.4 (39)	19.8 (41)
<b>Convicted</b>				
Rearrest	30.6	42.2	48.3	52.2
Reconvicted (%)	20.4 (67)	29.4 (70)	34.7 (72)	37.8 (72)
Reimprisoned (%)	13.4 (44)	20.2 (48)	24.1 (50)	26.9 (52)
<b>Imprisoned</b>				
Rearrest	32.3	42.5	49	53.0
Reconvicted (%)	22.6 (70)	30.6 (72)	36 (73)	39.2 (74)
Reimprisoned (%)	16.7 (52)	22.5 (53)	27 (55)	29.8 (56)

<sup>a</sup> The percentage of rearrested in each sample that is reconvicted.

<sup>b</sup> The percentage of rearrested in each sample that is reimprisoned.

### ***Samples***

Three main differences can be observed regarding the relationship between the sample criteria and the recidivism findings.

First, the level of reoffending is highest in the imprisoned sample and lowest in the arrested sample. This holds true for almost all measures and all measured durations. This indicates a positive relationship between more serious/back-end sample criteria and the proportion that reoffends, a finding that coincides with other studies (e.g. Ahven et al., 2010; Armstrong and McNeill, 2012; Haslund, 2003). It is also in the imprisoned sample that the highest proportion of arrested offenders commits serious offenses (that lead to conviction or imprisonment). Plausible explanations for these correlations may lie in the inclusion of low- and high-risk offenders in the various samples, which in turn leads to different risk structures based on, for example, social integration or stigma associated with earlier reoffending.

Second, the absolute levels of recidivism are most similar in the two most back-end samples, i.e. the convicted sample and the imprisoned sample. For instance, if we compare the cumulative proportion of reoffenders at the end of the observation period, the increase in absolute levels from the arrested sample to the convicted sample is (somewhat depending on measure) between 3 and 7 percentage points. The increase from the convicted sample to the imprisoned sample is slightly lower, between 1 and 3 percentage points, while the increase from the arrested sample to the imprisoned sample is the largest, between 4 and 10 percentage points. Although both relative and absolute differences vary by time elapsed, this pattern remains consistent after the first year. The similarity between the convicted sample and the imprisoned sample increases over time.

Third, the development over time is slightly different between samples. This matter will be described more thoroughly in the next section addressing the duration of follow-up.

### ***Measures***

An obvious and expected pattern of recidivism levels is the gradual decrease in the proportion of reoffenders within a given sample as we move from front-end to back-end measures. For instance, the proportion of reoffenders in the convicted sample is 48 percent after three years if we apply the measure based on rearrests, 35 percent if we apply the measure based on reconvictions, and 24 percent if we apply the measure of reimprisonments. Apart from this, two main points of divergence are evident.

First, it is clear that the described pattern between front-end/back-end measures and the proportion of reoffenders does not necessarily apply if we compare results *between* various samples. For instance, the proportion of *reconvicted* in the arrested sample is 16 percent after one year. If the negative association between a stricter/more back-end recidivism measure and less crime were absolute, we would expect recidivism measured as a *prison* sentence to be lower in all samples (when measured after the same number of months). However, the proportion of offenders reimprisoned during the first year under risk is 17 percent in the imprisoned sample. After two years, the measure of reconviction and reimprisonments yields the same proportion of reoffenders (23 percent) in these two samples. Although more an exception than a rule, these results provide an important modification of the commonly described pattern of decreasing rates of recidivism when measures become stricter. Second, the measures based on reconvictions and reimprisonments seem to yield more similar results than the measures based on reconvictions and rearrests.

### ***Follow-up period***

For the duration of follow-up, we can distinguish between absolute and relative levels and developments. Five main points of divergence are evident.

First, it is clear that the increase in the proportion of reoffenders is considerably steeper at the beginning of the follow-up period than at the end. This indicates that the largest “payoffs” in terms of a more complete picture of reoffending is retrieved during the first years. To go from a one-year to a two-year-long follow up leads to a relative increase in the proportion of reoffenders of between 32 and 51 percent depending on measure and sample, while the relative increase from two to three years and from three to four years is between 14 and 22 percent and 8 and 14 percent respectively. Depending somewhat on sample and measure, between 72 and 81 percent of those who relapse during the entire follow-up period do so during the first two years.<sup>21</sup> These are all relatively high figures, and lend support to prevailing recommendations of two years as a sufficient duration of follow-up (e.g. Armstrong and McNeill, 2012; Farrington and Davies, 2007; Graunbøl et al., 2010; Harris et al., 2009; Wartna et al., 2010).

Second, we can see that the development over time varies between measures. Figures 1.2, 2.2 and 3.2 show that the month with the highest conditional recidivism rates vary with the measure we apply, although all measures peak during the first three months. Table 2 shows that the measure based on rearrests has the lowest relative increase from year one to year two, while the measure of reimprisonments has the highest. Based on these numbers, it seems that the relapse to “any” crime (measured by a front-end measure) occurs sooner and then diminishes, while more serious reoffending (measured by a back-end measure) – although rarer – occurs later and has a more persistent development. In this case it would be recommendable to allow for a longer follow-up period when back-end measures are applied. It is worth noticing that this pattern is more evident in the arrested sample and the convicted samples than in the imprisoned sample, and that a longer follow-up period may be of particular importance when applying a back-end measure on a front-end sample.

Third, the development over time also varies between the three samples. As was the case with the measures of recidivism, the peak month for reoffending also varies somewhat between samples. In the arrested sample, the rearrest risk is highest during the first month, and the reconviction and reimprisonments risks are highest during the second month. In the convicted sample and the imprisoned sample, the risk is highest during the second and third months respectively (irrespective of which

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<sup>21</sup> These numbers are quite naturally affected by our definition of the duration of follow-up, and hence the “denominator” given by the total number of offenders that reoffend. Shortening the follow-up to three years, the proportion that reoffends within the first two years would increase to between 82 and 88 percent.

measure we apply). Apart from these minor differences, the temporal development in the imprisoned sample differs somewhat from the development in the other two samples – especially if we consider the measures based on reconvictions and reimprisonments. Due to higher conditional recidivism rates, and slower decline in these estimates during the first part of the follow-up period, the cumulative proportion of reoffenders is considerably higher in this sample than in the other two samples after one year. For instance, when measured at this time, the proportion of reoffenders is 78 percent larger in the imprisoned sample than in the arrested sample when we apply the measure of reimprisonments (17 vs. 9 percent). We can see from Table 2 that the *relative* increase from year to year is lowest in the imprisoned sample for almost all combinations of time and measure – and particularly so during the second year. This indicates that the higher absolute levels of reoffending in the imprisoned sample are primarily driven by this high rate of relapse early on, while the rate of relapse in the other two samples starts more slowly but shows more persistent relative development. This implies, as previously mentioned, that a longer duration of follow-up is advisable when examining recidivism by means of back-end measures in a more front-end sample. Furthermore, one may run a higher risk of overestimating the difference between samples if they are compared early on. If we look at the changes taking place during the second year, the highest absolute increase occurs in the convicted sample. This development indicates that the absolute levels among the conviction and the imprisoned samples converge, and that a comparison would seem less striking than it did one year earlier.

Fourth, we can see that the proportion of rearrested in each sample that is reconvicted or reimprisoned increases over time. This implies that an increasing number of those who reoffend later in the follow-up period receive more severe sanctions, a pattern that is particularly evident for the samples of arrested and convicted offenders. This lends further support to the notion that, when examined in more front-end samples, serious reoffenses call for longer follow-up periods.

Fifth, it is worth noticing that reoffending also occurs at the end of the follow-up period – even though the declining intensity is the most striking pattern. Skardhamar and Telle (2012) – to use another Norwegian example – find that survival curves (i.e. the opposite of our cumulative curves) level off after about two years, while this is not the case in our samples. During the fourth year, the absolute increase is between 3 and 4 percentage points depending on sample and measure, and the relative increase is between 8 and 14 percent.

### ***Summary***

The results from our analyses have provided the following insight on the impact of the sample criteria, measure of recidivism, and duration of follow-up on recidivism rates.



There is a positive relationship between stricter/back-end sample criteria and a higher proportion of reoffenders. This holds for almost all measures and measuring times, although the absolute levels of the conviction and the prison samples converge as time goes by. The development over time is somewhat different between samples, with the imprisoned sample relapsing sooner to serious crime than the other two samples.

We observed a decreasing proportion of reoffenders as we moved from front-end to back-end measures within a given sample. Nonetheless, our results demonstrate that this relationship does not necessarily apply *across* samples, and hence cannot be described as absolute. Furthermore, it is evident that the two most back-end measures (reconvictions and reimprisonments) yield more similar results than do the two most front-end measures (rearrest and reconviction).

It is evident that most new crimes are committed soon after the legal decision on the initial offense. Between 72 and 81 percent of those who relapse during the four-year follow-up period did so during the first two years, but it is worth noticing that some reoffending also occurs at the end of the follow-up period. The relapse to crime occurs sooner in the sample of released prison inmates than in the two other samples, particularly for the more serious felonies leading to reimprisonment. We suggest that a longer duration of follow-up is advisable when applying back-end measures of recidivism on front-end samples of offenders.

## **Conclusion and final remarks**

This article set out to explore how changes in the sample criterion, the measure of recidivism, and the duration of follow-up affected recidivism rates in Norway. We based our analyses on three samples of offenders (offenders arrested, convicted or released from unconditional prison for a felony offense in 2005), defined recidivism by means of three points of (re)contact between the individual and the criminal justice system (rearrest, reconviction or reimprisonment for a new felony offense), and recorded reoffending (measured by date of offense) taking place within a four-year time span.

The results from our discrete-time survival analysis show that the proportion of reoffenders varies between 9 and 53 percent,<sup>22</sup> depending on how the analysis is designed. We have replicated some well-known patterns of divergence; that the intensity of reoffending is highest at the beginning of the follow-up period, that the proportion of reoffenders decreases as we move from front-end to back-end measures within a given sample, and that the risk of reoffending is highest among those sentenced to

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<sup>22</sup> These values represent the one-year reimprisonment rate for the arrested sample (9 percent) and the four-year rearrest rate for the imprisoned sample (53 percent).

prison (c.f. Armstrong and McNeill, 2012; Bowles and Florackis, 2007; Langan and Levin, 2002; O'Donnell et al., 2008; Skardhamar and Telle, 2012).

Furthermore, we show that the temporal development in reoffending varies between both samples and measures. A high one-year rate of reoffending in the imprisoned sample leads to large initial differences between samples, but a more steady development in the other two samples (and particularly in the convicted sample) reduces these disparities over time. Overall, the samples of convicted and imprisoned, as well as the measures of reconvictions and reimprisonments, yield the most similar results. Our findings lend support to the recommendation of a follow-up of *at least* two years, and further suggest that a longer follow-up period is of particular importance when applying back-end measures of recidivism in front-end samples of offenders.

The most important limitations of our analyses follow from the use of registry data as our single data source. These data only reflect the proportion of offenses that are known to the police and that have a known offender. This will be affected by, among other things, the public's inclination to report crimes, current police practices and resources, and characteristics of the criminal justice system. This also suggests that these results do not necessarily hold across contexts, but which is up to future research to disclose.

We have shown that the more or less deliberate choices of the researcher in recidivism studies should receive more attention. The current study is very broad and descriptive in its nature, and it would be advisable to conduct more detailed analyses of, for example, crime types, and of differences between various offender groups and social and demographic groups. However, how recidivism is defined has consequences for the results in any recidivism study, and since recidivism is often politically highly relevant, such definitions can easily affect policies. For example, we have provided both high and low recidivism rates for Norway – all being relevant and accurate – and while the lowest figures might be taken to overrate Norwegian criminal policies, the highest figures might be taken to debunk those policies. Thus, the consequences of the definitions for the results need to be made explicit.

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## Appendix A

**Table 1: Cumulative recidivism rates for the arrested sample. With and without weights**

Time	Rearrest		Reconviction		Reimprisonment	
	With weights	Without weights	With weights	Without weights	With weights	Without weights
1	0.063	0.064	0.014	0.016	0.008	0.010
2	0.101	0.103	0.037	0.040	0.022	0.026
3	0.132	0.135	0.056	0.061	0.033	0.038
4	0.157	0.161	0.071	0.076	0.042	0.048
5	0.180	0.184	0.084	0.091	0.051	0.057
6	0.199	0.203	0.097	0.103	0.058	0.066
7	0.217	0.222	0.109	0.116	0.065	0.074
8	0.235	0.240	0.120	0.127	0.072	0.080
9	0.250	0.255	0.130	0.138	0.077	0.086
10	0.264	0.269	0.140	0.148	0.084	0.093
11	0.277	0.282	0.149	0.157	0.089	0.098
12	0.289	0.294	0.157	0.165	0.094	0.104
13	0.302	0.307	0.165	0.174	0.100	0.110
14	0.312	0.317	0.173	0.182	0.105	0.116
15	0.321	0.327	0.180	0.189	0.109	0.120
16	0.331	0.336	0.187	0.196	0.114	0.125
17	0.340	0.345	0.193	0.203	0.118	0.129
18	0.349	0.355	0.200	0.209	0.122	0.134
19	0.357	0.362	0.205	0.215	0.126	0.138
20	0.365	0.370	0.211	0.221	0.130	0.141
21	0.371	0.377	0.216	0.225	0.133	0.144
22	0.378	0.384	0.221	0.230	0.137	0.149
23	0.386	0.391	0.226	0.235	0.140	0.152
24	0.392	0.397	0.230	0.240	0.143	0.155
25	0.398	0.403	0.234	0.244	0.145	0.158
26	0.403	0.408	0.239	0.248	0.148	0.161
27	0.409	0.414	0.243	0.253	0.152	0.164
28	0.415	0.420	0.247	0.257	0.155	0.168
29	0.420	0.425	0.251	0.261	0.157	0.170
30	0.425	0.430	0.255	0.265	0.160	0.173
31	0.429	0.435	0.259	0.269	0.163	0.176
32	0.434	0.440	0.263	0.273	0.166	0.179
33	0.438	0.444	0.266	0.276	0.168	0.181
34	0.442	0.447	0.269	0.280	0.170	0.183
35	0.445	0.451	0.273	0.283	0.172	0.186
36	0.449	0.454	0.276	0.286	0.174	0.188
37	0.453	0.458	0.279	0.289	0.177	0.190
38	0.456	0.462	0.282	0.293	0.179	0.193
39	0.459	0.465	0.285	0.295	0.181	0.195
40	0.463	0.468	0.288	0.298	0.184	0.198
41	0.465	0.471	0.290	0.300	0.186	0.199
42	0.469	0.474	0.293	0.303	0.188	0.201
43	0.472	0.477	0.295	0.305	0.189	0.203
44	0.475	0.480	0.297	0.307	0.191	0.205
45	0.478	0.483	0.299	0.309	0.192	0.206
46	0.482	0.487	0.302	0.312	0.195	0.209
47	0.484	0.489	0.304	0.314	0.197	0.210
48	0.485	0.490	0.305	0.315	0.198	0.212

**Table 2: Cumulative recidivism rates for the convicted sample. With and without weights**

Time	Rearrest		Reconviction		Reimprisonment	
	With weights	Without weights	With weights	Without weights	With weights	Without weights
1	0.028	0.030	0.015	0.017	0.010	0.012
2	0.076	0.079	0.046	0.050	0.030	0.035
3	0.114	0.118	0.071	0.076	0.045	0.051
4	0.145	0.151	0.091	0.097	0.058	0.066
5	0.175	0.181	0.110	0.118	0.071	0.080
6	0.201	0.207	0.128	0.136	0.083	0.093
7	0.222	0.229	0.143	0.152	0.094	0.105
8	0.243	0.250	0.156	0.166	0.102	0.114
9	0.260	0.267	0.170	0.178	0.111	0.122
10	0.277	0.283	0.182	0.191	0.119	0.131
11	0.292	0.299	0.193	0.202	0.127	0.139
12	0.306	0.313	0.204	0.213	0.134	0.147
13	0.321	0.328	0.215	0.225	0.143	0.156
14	0.334	0.340	0.225	0.234	0.151	0.164
15	0.344	0.350	0.233	0.243	0.157	0.170
16	0.354	0.360	0.241	0.250	0.162	0.176
17	0.364	0.370	0.248	0.258	0.168	0.182
18	0.375	0.380	0.258	0.267	0.174	0.188
19	0.383	0.388	0.265	0.274	0.179	0.193
20	0.392	0.397	0.271	0.280	0.184	0.198
21	0.399	0.405	0.276	0.286	0.188	0.203
22	0.408	0.413	0.283	0.292	0.193	0.208
23	0.415	0.420	0.288	0.298	0.197	0.213
24	0.422	0.427	0.294	0.304	0.202	0.217
25	0.427	0.432	0.299	0.309	0.204	0.220
26	0.434	0.439	0.304	0.314	0.209	0.224
27	0.441	0.446	0.310	0.321	0.213	0.229
28	0.447	0.452	0.315	0.325	0.217	0.232
29	0.453	0.458	0.319	0.330	0.221	0.236
30	0.457	0.462	0.323	0.334	0.224	0.240
31	0.462	0.467	0.328	0.338	0.227	0.243
32	0.467	0.472	0.332	0.342	0.230	0.246
33	0.471	0.476	0.335	0.345	0.233	0.249
34	0.476	0.481	0.340	0.350	0.236	0.252
35	0.480	0.485	0.344	0.354	0.239	0.255
36	0.483	0.488	0.347	0.357	0.241	0.257
37	0.487	0.492	0.350	0.360	0.244	0.260
38	0.491	0.496	0.353	0.364	0.246	0.263
39	0.496	0.500	0.356	0.367	0.249	0.265
40	0.499	0.503	0.359	0.369	0.251	0.268
41	0.501	0.506	0.362	0.372	0.254	0.270
42	0.504	0.509	0.364	0.375	0.256	0.273
43	0.507	0.511	0.367	0.377	0.258	0.275
44	0.510	0.514	0.368	0.379	0.260	0.276
45	0.513	0.517	0.370	0.380	0.261	0.277
46	0.519	0.523	0.374	0.384	0.265	0.281
47	0.521	0.526	0.376	0.386	0.267	0.283
48	0.522	0.526	0.378	0.388	0.269	0.285

**Table 3: Cumulative recidivism rates for the imprisoned sample. With and without weights**

Time	Rearrest		Reconviction		Reimprisonment	
	With weights	Without weights	With weights	Without weights	With weights	Without weights
1	0.027	0.032	0.018	0.023	0.015	0.020
2	0.073	0.087	0.047	0.061	0.034	0.048
3	0.119	0.136	0.080	0.097	0.059	0.076
4	0.154	0.173	0.102	0.122	0.075	0.095
5	0.183	0.203	0.125	0.147	0.092	0.115
6	0.208	0.229	0.144	0.167	0.105	0.129
7	0.234	0.255	0.161	0.185	0.118	0.143
8	0.253	0.275	0.175	0.199	0.126	0.152
9	0.276	0.298	0.191	0.216	0.139	0.165
10	0.291	0.313	0.202	0.228	0.147	0.175
11	0.308	0.330	0.215	0.241	0.158	0.186
12	0.323	0.345	0.226	0.253	0.167	0.196
13	0.337	0.359	0.237	0.264	0.174	0.204
14	0.348	0.371	0.245	0.273	0.180	0.210
15	0.359	0.382	0.252	0.279	0.184	0.215
16	0.368	0.390	0.260	0.287	0.190	0.222
17	0.377	0.399	0.265	0.292	0.194	0.225
18	0.386	0.408	0.272	0.300	0.202	0.233
19	0.393	0.415	0.278	0.305	0.205	0.235
20	0.399	0.421	0.284	0.312	0.209	0.241
21	0.407	0.428	0.290	0.317	0.213	0.244
22	0.411	0.433	0.294	0.322	0.216	0.247
23	0.419	0.441	0.300	0.328	0.220	0.251
24	0.425	0.447	0.306	0.334	0.225	0.257
25	0.431	0.453	0.311	0.338	0.228	0.260
26	0.436	0.458	0.314	0.342	0.231	0.263
27	0.442	0.464	0.319	0.346	0.235	0.267
28	0.449	0.470	0.323	0.351	0.240	0.271
29	0.453	0.475	0.328	0.356	0.244	0.276
30	0.458	0.479	0.332	0.360	0.248	0.280
31	0.463	0.484	0.337	0.365	0.252	0.284
32	0.469	0.490	0.341	0.368	0.255	0.287
33	0.474	0.495	0.344	0.372	0.257	0.289
34	0.478	0.498	0.348	0.375	0.260	0.292
35	0.482	0.502	0.352	0.379	0.263	0.295
36	0.486	0.506	0.355	0.382	0.266	0.298
37	0.490	0.510	0.358	0.385	0.268	0.300
38	0.495	0.514	0.361	0.388	0.271	0.303
39	0.498	0.517	0.364	0.390	0.273	0.305
40	0.501	0.520	0.366	0.393	0.276	0.307
41	0.503	0.523	0.368	0.394	0.278	0.309
42	0.507	0.526	0.372	0.398	0.278	0.310
43	0.512	0.531	0.375	0.402	0.282	0.313
44	0.516	0.535	0.379	0.406	0.286	0.317
45	0.521	0.540	0.384	0.410	0.289	0.320
46	0.525	0.544	0.388	0.414	0.294	0.325
47	0.527	0.546	0.390	0.416	0.296	0.327
48	0.530	0.548	0.392	0.418	0.298	0.329



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