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PRISON AS A CRIMINAL SCHOOL: PEER EFFECTS AND CRIMINAL LEARNING BEHIND BARS

ANNA PIIL DAMM AND CÉDRIC GORINAS

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Prison as a Criminal School: Peer Effects and Criminal Learning behind Bars*

Anna Piil Damm[2] and Cédric Gorinas[3]

Abstract

We investigate peer effects on crime-specific recidivism, using register data for the entire Danish prison population. In line with a logic of crime specialisation we do not find that inmates build *new* criminal capital in prison but rather *strengthen* criminal capital due to exposure to offenders with the same field of specialisation (i.e. reinforcing peer effects). Our results accord with a theory of crime-specific knowledge transmission and network building in prison: we find reinforcing peer effects for crimes that require crime-specific capital, planning and network (e.g. drug crimes, theft, burglary and fencing) and/or are more effective when committed in groups (e.g. threats and vandalism). We find no reinforcing peer effects on recidivism with crimes that tend to be committed spontaneously and solo (e.g. violence and sexual assaults, weapon possession). Our findings carry important implications for prison assignment policies.

Keywords: crime, peer effects, young criminals, prisons

JEL Classification codes: K4, J10

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The social and economic costs of crime are high: tentative estimates arise to almost $ 200 billion for the US (U.S. Department of Justice, 2004, 2008), £ 60 billion for the UK and Wales (Brand and Price, 2000), and even higher if we consider opportunity costs (Anderson, 1999). A remarkable part of those estimates reflects government expenses to reduce crime, including deterrence through imprisonment. We know that crime is much more common among men and peaks in late adolescence and early adulthood (Hirschi and Gottfredson, 1983, 1985; Greenberg, 1985; Steffensmeier et al., 1989; Andersen and Tranæs, 2011), and given its illegal nature criminal capital is likely to be transmitted through social networks and interactions with delinquents (Case and Katz, 1991; Reiss, 1988; Glaeser et al., 1996; Ludwig et al., 2001; Kling et al., 2005).[4] Few studies, however, have been able to establish a causal relationship between peer interactions and criminal behaviour. Among those are Ludwig and Kling (2007), Damm and Dustmann (2014), Bayer et al. (2009), Drago and Galbiati (2012). Exploiting the Moving-To-Opportunities Demonstration in five American cities, Ludwig and Kling (2007) find no effect of neighbourhood crime on juvenile arrests for violence. Exploiting quasi-random assignment of refugees across Danish municipalities and using a similar measure, Damm and Dustmann (2014) also do not find any effect of neighbourhood crime on juvenile delinquency. However, they find a causal relationship between the *youth* crime conviction rate in the neighbourhood and male juvenile delinquency. The youth crime conviction rate of individuals from the same ethnic group has an even larger effect than the overall youth crime conviction rate. Therefore, if peer effects reflect social interactions, peer effects on crime appear to operate more strongly due to preferences for interactions and sorting into groups of more alike persons. The definition of the peer group then becomes crucial for the researcher studying peer effects on crime.

Compared to the neighbourhood or even the class room, prisons present two unique features particularly appropriate to study peer effects on crime: all peers are (suspected) offenders and the peer group is constantly evolving over time with the admittance and release of inmates, as sentences begin and expire. Bayer et al. (2009) exploit these unique features of Florida's juvenile correctional facilities to identify peer effects on recidivism among juvenile offenders. Using facility-by-prior-offence fixed effects and incarceration-time fixed effects to deal with non-random prison assignment, Bayer et al. (2009) show that juveniles acquire and particularly strengthen criminal capital behind bars due to peer effects. Indeed, a juvenile who serves time with offenders with a similar criminal background is more likely to recidivate with the same type of offence. Also using

[4] See also, e.g. the pioneer works of Becker (1968) on the determinants of criminal behaviour and Freeman (1999) for an extensive literature review.

data on prisoners, Drago and Galbiati (2012) exploit a pardon policy that adds the remaining sentence to any future prison sentence as extra punishment. They show that the indirect positive effect of prison peers' residual sentence on recidivism is as large as the direct effect of an individual's residual sentence. Another related study of peer effect on crime is Lindquist and Zenou (2014), who use data on suspected offenders and show the role of *key players* in active co-offending networks.

Our study investigates empirically whether young adults incarcerated for the first time acquire new or strengthen criminal capital behind bars due to exposure to inmates with particular criminal background. Our results have important policy implications for prison assignment policies, which are discussed not only by the Danish Prison and Probation Service but also by national policy makers. For example after a sudden increase in gang wars, the Danish parliament voted a reform in 1999 to establish highly secured sections within certain prisons for gang members and strongly negative inmates. This reform aimed primarily at protecting prison staff from particularly violent, threatening and hardly controllable inmates. Another direct consequence of this reform was to minimize the criminal influence of gang members on less experienced criminals (The Danish Parliament, 2000). By extracting the population of young first-time incarcerated in the years well before the reform, i.e. before less experienced criminals were isolated from gang members, we can test empirically whether in-prison exposure to criminals who are more experienced in terms of conviction records, i.e. a proxy for gang members, increases recidivism rates of relatively less experienced criminals. Therefore, our findings to some extent predict the effects of the Danish reform on recidivism of young first-time incarcerated individuals.

Our hypotheses are that, in accordance with the homophily principle and gains from crime specialisation, inmates do not acquire new criminal capital due to exposure to experts with other crime fields of specialisation during incarceration (hypothesis I) but rather strengthen their criminal capital due to exposure to experts in their own crime field of specialisation (hypothesis II). We refer to the first type of peer influence as an (absence of) *introductory peer effect* and the second type of peer influence as a *reinforcing peer effect*.

We present two competing theories about how exposure to experts in the inmate's own crime field strengthens criminal capital, i.e. on how re-inforcing peer effects operate. Our first theory draws on a crime-specific social norm spillover channel to posit that exposure to experts in the inmate's own crime field of specialisation strengthens his criminal identity as that type of criminal. Our second theory predicts that for crimes requiring skills, planning and/or illegal networks or

groups to be more effective reinforcing peer effects might operate via a logic of social information and network spillovers in prison. For such crimes, exposure to experts in the inmate's own crime field of specialisation increases his gains from further specialisation in that type of crime due to e.g. crime-specific knowledge transmission, network building and planning of co-offending post release.

Note that our theories on how inmates strengthen their criminal capital behind bars lead to two different predictions, which we can test. The first theory predicts that a reinforcing peer effect exists irrespective of the offender's crime field of specialisation. The second theory predicts that a reinforcing peer effect exists only for crime fields that require skills, illegal networks and/or planning.

To identify peer effects we exploit the unique feature of prisons where the peer group is constantly changing over time with the admittance and release of inmates, as sentences begin and expire. Similar to Bayer et al. (2009) we use facility-by-prior-offence fixed effects and incarceration-time fixed effects to rule out any possibility of non-random prison assignment and thus identify peer effects from the random variation in the timing and duration of the incarceration overlap of each pair of inmates in a facility. Suppose two incarcerated individuals with the same socioeconomic and criminal background, e.g. in drug-related offences, serve time in the same facility but enter and exit the prison at different dates. In that case the two individuals are exposed to different shares of e.g. drug offenders among inmates. Using register data, we observe this difference and then test whether a higher share of e.g. drug offenders among fellow inmates increases the individual's probability of recidivism with e.g. drug-related crime: we test for a reinforcing peer effect on drug-related offending. Similarly, if two drug convicts are exposed to different shares of e.g. thieves among fellow inmates, we can test whether a higher share of e.g. thieves increases a drug convict's risk of recidivism with theft. If this is the case, this finding would typify an introductory peer effect for theft.

Our study adds to the peer effect literature and to the scant literature on peer effects in prison in at least four ways. First, in comparison to Bayer et al. (2009), we study peer effects for young adults (age 18 to 21) in a non-US context and using unique data: linked administrative and crime registers for the entire Danish population covering all sentencing institutions in Denmark over a ten-year period. The advantage of extracting a sample of young adults is that they serve time in regular prisons where inmates differ not only in terms of criminal background but also in terms of other characteristics like age, ethnicity, area of origin, level of education and prison experience. Therefore, thanks to the exhaustive information on prison inmates' demographic, socioeconomic

and criminal characteristics available in the Danish administrative registers we can shed light on whether inmates sort into or are more influenced by specific groups in prison. Indeed, individuals' preferences for connecting with similar people is well-documented (e.g., the homophily principle).[5] Also in a criminal context, as the findings of Damm and Dustmann (2014) show, the transmission of criminal capital or identity is more likely between delinquents and individuals with peers alike in terms of, e.g., age and ethnicity. Therefore, in our empirical tests of peer effects on recidivism we gradually narrow the definition of the potential peers among co-inmates.

Second, we study peer effects for a sample of first-time prison inmates. Looking only at first-time incarcerated offenders allows us to study more clearly the transmission of criminal behaviour that happens behind bars, including the transmission of crime capital from more experienced fellow inmates, and yields a more homogeneous sample. Focusing on first timers moreover eliminates the risk ofunobserved bias associated with prior incarcerations.

Third, we add to the scarce literature on peer effects in prison by suggesting new competing and testable theories on how peer effects on recidivism operate in prison. By testing competing theories on peer effects in prison and co-offending post release with former inmates, we investigate the channels and mechanisms through which peer effects operate in prison. Our analysis of co-offending adds to the small literature on co-offending in general[6] and co-offending between previous prison inmates in particular[7].

Fourth, we submit our results to a series of sensitivity checks and provide evidence on peer effects on crime-specific recidivist behaviour both at the extensive margin (i.e. the reiteration of specific crime) and the intensive margin (i.e. the number of new convictions of specific crime). We thereby address the challenges of identifying peer effects on recidivism on the basis of administrative crime records given that, by the end of each year, a substantial fraction of crimes reported during the year is undetected (in Denmark, on average 20% of annual reported crimes over the 1986-1999 period were detected, Statistics Denmark, 1986-1999). In addition, we further address the problem of undetected crimes by exploiting the entire criminal past of peers to distinguish between "stupid" versus "clever" peers, arguing that – in contrast to clever peers – stupid peers are unable to teach fellow inmates how to avoid detection. Therefore, we expect to find stronger reinforcing peer effects after limiting the peer group to stupid co-inmates.

[5] See e.g. McPherson et al. (2001) for an overview of the principle's significance for social networks formation.
[6] See e.g. Reiss and Farrington (1991), Carrington (2009), van Mastrigt and Farrington (2011), Lindquist and Zenou (2014).
[7] See Roxell (2011).

In our analyses, we distinguish between seven representative and easy-to-interpret types of offences that vary with respect to their level of necessary criminal capital, degree of planning and network or group involvement: i) violent and sexual offences, ii) robbery, iii) vandalism and arson, iv) burglary, theft and fencing, v) drug-related offences, vi) weapon-related offences, and vii) threats against the person and public authorities. We argue that crimes in categories ii) and v) as well as some offenses in iii) (e.g. burglary and fencing) require skills and planning and a network, while crimes in category i) and vi) and most offenses in iii) (simple theft) require few skills and are often committed spontaneously and solo. Crimes in categories iii) and vii) do not necessitate illegal networks to the same extent than categories ii), v) and some offenses of iii), but they are more "*effective"* in groups and often are motivated by oppositional norms.

Using unique and detailed register data, taking into account selection into prisons and relying on within-prison-within-crime variation we find little evidence of introductory prison peer effects for the population of young first-time incarcerated individuals in Denmark. By contrast, in line with our second theory of reinforcing peer effects due to crime-specific knowledge transmission, network building and planning of co-offending post release, we find strong evidence of reinforcing peer effects for crimes that require crime-specific capital, planning and/or a network and/or are more effective when committed in groups: vandalism and arson, burglary, theft and fencing, drug-related crimes and threats against the person and public authorities; we also find suggestive evidence of a reinforcing peer effect on recidivism with robbery. Finally, we do not find reinforcing peer effects on recidivism with violent and sexual offenses and weapon-related offenses. Around the mean, we find that a one standard-deviation increase in the relevant peer group increases the probability of reoffending within the crime field of specialisation within twelve months after release by 1% for drug-related crimes and vandalism and arson and 2% for theft, burglary and fencing and threats.

The rest of the paper is organized as follows. Section 1 discusses practices in Danish sentencing institutions. Section 2 introduces the data and presents summary statistics. In Section 3 we derive our testable hypotheses and explain our empirical model and identification strategy. Section 4 follows with a presentation of the baseline results and the investigation of the network sorting in prison. In Section 5 we present results from sensitivity analyses to address the possibility of undetected crime. Section 6 investigates possible channels through which reinforcing peer effects operate in prison. Finally, we discuss our findings and draw conclusions and policy implications in Section 7.

1. Danish Sentencing Institutions

1.1. Contemporary Prison Assignment Criteria

The Danish Prison and Probation Service (thereafter DPPS) decides upon the assignment of criminals to sentencing institutions based on the convict's sentence, age and residence location, typically in two stages. First, the DPPS chooses the type of institution: open or closed prison.[8] In closed prisons, all doors and gates are locked at all time and a higher level of security and monitoring is enforced. In contrast, open prisons look more like ordinary buildings and allow inmates to have regular contact with their families and go outside prison during the day for school, work or rehabilitation. By law offenders with an unconditional sentence are assigned to an open prison but if their sentence exceeds five years, if they need special protection or monitoring or are members of gangs they might be sent to a closed facility. A third type of prison, local prisons, primarily serve for custody but offenders whose sentence does not exceed the time spent in custody and, since 1999 and only in separate sections, members of certain gangs may serve their entire sentence in local prisons, which have similar rules and conditions to closed prisons (DPPS, 2013).[9]

Second, the DPPS designates a particular facility depending on the convict's age, family, employment or education situation. Offenders of age 18 or 19 are typically sent to an open prison close to their residential address, so that they can stay close to family and easily remain enrolled (or become so while serving time) in school. Offenders aged 20-22 assigned to an open prison can go to any open institution, whereas offenders of that age assigned to a closed prison must serve their time at the prison of Ringe. [10] If the convict has young children or parents who need care, special medical needs (e.g. drug or gambling addictions) or an education or employment likely to return to after release, he may be assigned to an open prison.[11] Finally, capacity constraint may influence the DPPS' assignment decision too. If none of the determinants above applies, the DPPS internal guidelines prescribe assignment of criminals to a sentencing facility located in their municipality of

[8] For some groups of offenders alternative sentencing forms exist. For instance, juveniles and persons with medical needs can serve their sentence in treatment institutions, including half-way houses and, since 2005, offenders with a sentence of less than five months can avoid custodial serving via electronic monitoring.

[9] In addition to the country's 36 local prisons, the term local prison encompasses the custody departments in three closed state prisons (Nyborg, Vridsløselille and Østjylland).

[10] In our sample 17 individuals serve time in the prison of Ringe. They all enter the prison between 18 and 20 and all their co-inmates are below age 26. In a robustness check (not shown here), we exclude those 17 individuals and find unchanged results.

[11] The DPPS accesses detailed information on each convict from a visitation scheme filled out in custody by the personnel and the offender as well as the criminal dossier provided by the Police. In contrast to the dossier provided by the Police, the content of the visitation form cannot be encrypted and is therefore unobserved by us. Most information in the form concerns inmates' previous incarcerations, and we choose to look only at individuals incarcerated for the first time.

residence. Young inmates, especially, may transfer to a facility closer to home towards the end of their sentence to ease reinsertion, for instance via education enrolment. Our data allow us to observe the entry and release date for each facility incarceration as well as individual factors influencing prison assignment such as age, level of education, family situation, and municipality of residence.

1.2. Inmates' Social Interactions within Facilities

Each facility deliberately decides in which facility section to assign an offender. Typically there are no special sections for young convicts; only juveniles serve time in special sections.[12]

Possibilities for daily interactions between inmates are multiple. Except in highly secured sections, inmates can meet across sections during the day while attending classes and workshops or exercising in the yard. Moreover, inmates share kitchen amenities with the rest of the section, and some open prisons have double cells. The cell composition constantly varies according to the current need of the facility and thus is not registered. Possibility for electronic communication is limited: inmates have access to new technologies when necessary for daytime training, but only relevant websites are accessible and mobile phones are prohibited. Although inmates have the possibility to interact and become acquainted with one another, they do not necessarily do so. In a qualitative study of a Danish closed prison Minke (2012) explores social life in a closed institution. Half of the 615 inmates in her survey report that they have become friends with other inmates, but this result varies with inmates' age and criminal history: inmates younger than 23 report stronger social cohesion than older inmates, and typically inmates tend not to interact with drug convicts (Minke, 2012: 163). Another Danish field study among juvenile inmates find that juveniles prefer to socialise with inmate peers from the same city and with the same social networks outside prison (Bengtsson, 2012).

2. Data

2.1. Primary Data Sources, Sample Construction, and Peer definitions

Our data stem from five sources covering the entire Danish population: (1) the Central Police registers on individual incarcerations in Danish facilities; (2) the Central Police registers on individual crime convictions; (3) the Central Police registers on individual crime charges; (4) the administrative registers, which provide individual demographic characteristics; and (5) the

[12] Since 1999 gang members have served time in highly secured sections within the prison. This policy was first decided by the Danish parliament as part of the State Budget (Finanslov) for 1999, i.e. some years after the sudden increase in gang wars in Denmark. Only two prisons had established a highly secured section for "gang members or strongly negative inmates" prior to 1999: the state prison in Nyborg (from August 1998) and the state prison in Vridsløse (1992-1994, with room for around 20 persons). Only 9 individuals in our sample serve time in those prisons.

Educational Institution Register and Surveys, which provide information about individual educational attainment. We can link individual records from the five registers using a unique person identifier for Danish residents. Although registers are available for the period 1980-2009, we limit our observations to the years between 1991 and 2006 for two reasons. First, the Central Police registers lack information about the date of release before 1991. Second, due to a reform that modified Police districts Statistics Denmark started to code sentencing facilities differently from 2007. For this period we use data on the date of incarceration, the date of release, and the identifier of the facility to construct facility-specific spells of incarceration for all prisoners. Moreover, we use information on the date of conviction, the sentence and the type of offence to construct individual crime histories.

Our sample encompasses all offenders incarcerated for the first time between 1994 and 1997 at age 18 to 22. We only consider first-time incarcerated offenders to ensure a more homogeneous sample free of possible residuals from peers' interactions during earlier incarcerations and to avoid the simultaneity problem inherent in empirical analyses of peer effects – commonly referred to as the reflection problem (Manski, 1993). As a result we study the transmission of criminal capital from more experienced inmates. We focus on young adults because most juvenile offenders serve time in half-way houses, which do not appear in the registers before 2007. Moreover, according to the DPPS, incarcerated juveniles typically have a serious criminal background that for the most has been sanctioned by other means than incarceration due to their young age. By contrast, young adults convicted of an unconditional sentence are less likely to be habitual offenders. We set 22 as the upper age limit because this age is used as a threshold in the prison and section assignment decision (e.g. the prison of Ringe houses mainly men under age 23, while all men in the institution of Vridsløselille are 23 or older). We look at persons incarcerated from 1994, i.e. three years after the beginning of the registration of the release date in the registers and to control for prior convictions since the responsible criminal age. We exclude individuals incarcerated after 1997 to avoid any bias from a reform voted in 1997 (*Voldspakke II*)[13] and the reform voted in 1999 to establish highly secured sections for gang members or strongly negative inmates within prisons. As a result, we get a sample of 1,928 individuals incarcerated between 1994 and 2003.

[13] *Voldspakke II* was voted in May 1997 (law no. 350 on 23 May 1997). To our knowledge, the only study that evaluates the causal effect of the reform on incarceration length for violent crime is Landersø (2012), who shows a significant increase by 13 percent (p10) of a 2002 change of the reform in the penal code, and no other study documents any effects of the reform before 2002. Nevertheless, as we cannot exclude that *Voldspakke II* might have caused a sudden increase in sentence for violent offenders convicted after the reform, we restrict our observations to people incarcerated before 1997. See Sections 3 and 4 for tests of our identification strategy.

We measure individual *i*'s relative exposure to fellow inmates with a criminal history with offence *h* in facility *j* until his date of release *t,* henceforth denoted $peer_{ijt}^{h}$, as the time-serving days of overlap between individual *i* and his fellow inmates with criminal history with offense *h* in facility *j* relative to individual *i*'s time-serving days of overlap with all his fellow inmates in facility *j*. This relative time-serving overlap is equal to the sum of the weighted shares in Eq. (1)

$$peer_{ijt}^{h} = \sum_{\tau_j=t_1-t_0}^{t_n-t_{n-1}} share_{ij\tau_j}^{h} \frac{\tau_j}{(t-t_0)} \quad (1)$$

where t_0 is the date of incarceration of individual *i* in facility *j* and $share_{ij\tau_j}^{h}$ denotes individual *i*'s share of prison *j* peers in period τ_j who have a criminal history with offence *h*.

Recall that individuals in our sample are 18-22 years old at the time of incarceration. Since inmates are likely to sort into networks in terms of age (Damm and Dustman, 2014) and for the purpose of comparability with the peer-effect study by Bayer et al. (2009) in juvenile correctional facilities, we use two alternative peer definitions in our baseline: all-age peers (Peer Definition I) and a narrower definition of peers under age 26 (thereafter *young* peers, Peer Definition II).

To explore more specifically the social sorting of inmates for each baseline peer definition we construct even narrower peer definitions: *(*young) inmates of the same ethnic group (Western or non-Western) and (young) inmates from the same county of residence. To deal with the problem that far from all committed crimes are detected, it is also useful to distinguish between stupid and clever co-inmates, in particular (young) inmates who did not complete an upper-secondary education and inmates who completed an upper-secondary education, (young) inmates who spent more than 180 days of their life behind bars (thereafter "hard criminals"), (young) inmates who spent more than 180 days of their life behind bars over less than three sentences (thereafter "clever hard criminals") and (young) inmates who spent more than 180 days of their life behind bars over three or more sentences (thereafter "stupid hard criminals").

2.2. Descriptive Statistics

We focus on seven categories of offences for criminal history and crime committed post release: (i) sexual and violent offences, (ii) robbery, (iii) vandalism and arson, (iv) burglary, theft and fencing, (v) drug-related offences, (vi) offences against the weapons act, and (vii) threats against the person and public authorities. We choose these seven crime categories on the basis of four selection criteria: easy interpretation for policy purposes, comparability with previous studies, the probability of recidivism with the crime category should be high enough for a precise estimation, and the crime categories in the analysis represent skill and network intensive offences as well as offences that do

not require particular criminal capital or network/group and tend to occur spontaneously. Accordingly, we disregard the categories "other offences and unknown type of crime" and "offences against the tax act and other special acts", both difficult to interpret, as well as "offences against the road traffic act", which often are disregarded in crime studies and criminal statistics (e.g., Andersen, 2014; U.S. Department of Justice, 2014). Moreover, as no individual in our sample recidivates with "decency, procuring and child pornography", we disregard this category too. We do not include falsification and white-collar crimes, since those offenses are typically committed by more educated criminals (Lochner, 2004) and very few individuals in our sample have completed high school.

Earlier works show that offences such as violent offences, threatening behaviour, possessing illegal weapons, and receiving stolen goods tend to be more spontaneous and committed solo (Reiss and Farrington, 1991; Natarajan, 2000; Lochner, 2004; Finckenauer, 2005; Carrington, 2009; Roxell, 2011; Ouss, 2014). By constrast, we expect other types of crime such as drug-related offences, burglary and robbery to require criminal networks and some organisation. Moreover, although threatening and vandalist behaviour might not require criminal networks to the same extent as e.g. drug-related crimes, threats, vandalism and arson crimes are often motivated by oppositional norms and emerge from collective mobilisation.[14] Therefore, from a criminal's perspective we expect those offences to be more "effective" when committed in groups; a group of demonstrators, vandals or part of a criminal gang are more likely to be perceived as threatening by e.g. police agents than a single demonstrator, vandal or gang member. In the following section, we formulate two hypotheses to test the relevance of group/network and planning for prison peer effects on future crime.[15]

Table 1 depicts the summary statistics of our main dependent, explanatory and control variables. According to the summary statistics for our baseline dependent variable 53% of our

[14] Vandalism or arson is the expression of a rebellious or anti-social behaviour motivated by frustration, anger, boredom or revenge (Nordmarker, 2010) that often targets something specific and is politically motivated (Wittingham, 1981). Hence, inmates with a background in vandalism/arson might share a peculiar oppositional identity and gather around a common purpose of vandalism.

[15] Finckenauer (2005) highlights the importance of distinguishing "organized crime" (perpetrated by established criminal organisations) from "crime that is organized" (which necessitates a high degree of organisation; see p76 in Finckenauer, 2005) along with the irrelevance to assign particular offences to the *organized crime* category. Notwithstanding, scholars have assessed that drug crime, for instance, necessitates some organisation but is rarely an *organized crime*. Indeed, it typically relies on small groups that quickly form and dissolve (Eck and Gersh, 2000) and operate similarly to small family businesses (Natarajan and Belanger, 1998; Natarajan, 2005), but does not necessarily typify highly sophisticated planning and structure with self-identifed organized criminals who use authority of reputation to achieve their means (i.e. criminal organisation, Finckenauer, 2005). In our study of peer effects in Danish prisons, we discuss peer effects on crime only in the context of crimes that necessitate some organisation but do not analyse the development of organised crime.

sample recidivates within one year. 26% commit theft, burglary and fencing, 8% violent and sexual offences, 7% drugs, 3% vandalism or arson, 2% threats, 2% weapons offenses and 2% robbery, while 23% commit another type of offense. Moreover, 69% get a new conviction within two years and 76% within three years. In terms of demographics 95% of inmates in our sample are male and 88% ethnic native[16] and the average imprisonment age is 19. Moreover, 10% have children younger than six but only 0.2% are married, and only 8% have obtained an upper-secondary education at the time of incarceration. On average imprisonment lasts for 43 days, and 26% of individuals serve their sentence across several facilities.[17] Most individuals are housed in an open institution (66%, against 7% in a closed prison and 27% in a local prison.

In terms of prior convictions, 45% of the sample has experience with violent and sexual offences, 53% with theft, burglary and fencing, 13% with vandalism and arson, 11% with drugs, 10% with offenses against the weapons act, 7% with robbery and 6% with threats. The 48% individuals previously convicted of "other offences" are mostly convicts of traffic offences (37%).

Most co-inmates are males (96%), of Western origin (92%), without an upper-secondary education degree (76%), and 70% are older than 26. Turning to the criminal background of all-age peers, we notice differences in criminal background. Only 12% are earlier convicts of violent and sexual offences, 20% of theft, burglary and fencing, and 10% of drug-related offences. When limiting peers' age to under 26 (Peer Definition II), the share of violent and sex convicts increases to 17%, the share of convicts of theft, burglary and fencing to 25%, while the share of drug convicts slightly decreases to 8%.[18] 24% of all-age (20% of young) peers are *hard criminals*, i.e. they have already spent more than six months of their life behind bars. In addition, the average number of inmates is 57, of which on average 17 are younger than 26.

Finally, our control variables include socioeconomic characteristics of the individual's former municipality of residence and weighted characteristics of fellow inmates' former municipality of residence which may influence individual crime behaviour (Ludwig and Kling, 2007; Damm and Dustmann, 2014). The average real gross income per capita in the individual's former municipality of residence is just above DKK 200,000 (app. USD 34,000), the unemployment rate is 9.3%, and

[16] We follow the immigrant definition of Statistics Denmark. Immigrants are born abroad of parents without Danish citizenship and born outside Denmark. Descendants are born in Denmark and none of their parents are both Danish citizen and born in Denmark. The average overall share of the immigrant and descendant population in Denmark is about 7.5% in the same period (Statistics Denmark, 2015).

[17] For individuals who serve their sentence across several institutions, the longest spell represents about 40% of the total duration of incarceration.

[18] For descriptive statistics on the criminal history of peers following alternative peer group definition, refer to **Table A2**.

the overall youth crime conviction rate (after exclusion of traffic offences) is 2.4%. The mean value of the weighted unemployment rate of peers' former municipality of residence is 9.6% and the youth conviction rate is 2.3%.

[**Table 1** about here]

3. Theory, hypotheses and empirical research strategy

3.1 Crime specialisation, network sorting and hypotheses

We can draw on theories from criminology and economics to understand why and how peer effects on crime may operate in prison. Since Clemmer (1940) criminologists have provided extensive evidence to support *prisonization theories*, according to which prisons through "the folkways, mores, customs, and general culture of the penitentiary" (Clemmer, 1940, p299) foster and reinforce deviant behaviour. According to this theoretical framework, the simple fact of spending time in prison with other inmates augments the odds of recidivism and a criminal career.[19] However, two questions emerge when studying peer effects with such a framework in mind. First, one may wonder whether certain prison fellows, as defined by their demographic and criminal characteristics, are more influential than others in terms of deviant behaviour. Put differently, the question is whether network sorting happens in prison and, if yes, which groups lead to higher risks of crime recidivism. A second question relates to the limitation of the prisonization theories to explain crime-specific recidivism and the reiteration of similar offending behaviour. In other words, one may wonder whether, due to exposure to influential criminal peers, inmates become more likely to recidivate: i) in general with any type of crime, ii) with types of offence they have not committed before, iii) or with offence categories of which they are earlier convicts (i.e. crime specialisation).

We start by examining how general theories of social interactions, beyond the prisonization theories, can shed light on these two questions. There is evidence that social networks form among people of similar characteristics such as age and ethnicity, e.g. the homophily principle.[20] In a prison context, Bayer et al. (2009), who have data on criminal background and crime-specific

[19] See also Sykes (1958) and Thomas (1977) for an overview of the prisonization theories. For empirical evidence, see Roxell (2011) who finds that transmission of *prisonization* norms intensifies with the number of inmates and peaks at the second third of a completed sentence, and Minke (2012) who finds that it affects notably young inmates and convicts of drugs, property or violent crimes. A recent experiment among inmates also shows that salient criminal identity increases dishonest behaviour (Cohn et al., 2015).

[20] See e.g. McPherson et al. (2001) for an overview of the principle's significance for social networks formation and e.g. Damm (2014) for quasi-experimental evidence of job network formation on the basis of ethnic and gender similarity. Also in a criminal context, Damm and Dustmann (2014) provide quasi-experimental evidence that the transmission of criminal capital or identity is more likely between delinquents and individuals with peers alike in terms of, e.g., age and ethnicity.

revidivism for juvenile inmates in Florida, show that inmates tend to form social networks in prison with peers of similar criminal background. The authors show that due to interactions with these peers inmates specialise in offences of which they are earlier convicts. This finding makes sense if individuals experience increasing returns from reiterating similar types of crime due to accumulation of criminal capital, criminal networks, access to opportunities or natural abilities. Similar to Bayer et al. (2009) we use data on prior crimes and recidivism to examine individual probabilities of crime specialisation upon release. Concretely, using our sample of first-time incarcerated individuals aged 18-21 at the date of incarceration we run OLS regressions of the probability to recidivate with offence h conditioning on criminal history in the seven types of offences (**Table 2**). The estimates show that having been convicted of a particular type of offence is positively and often significantly correlated with the propensity to recidivate with the same offence, and not with a new type of offence. Indeed, an earlier convict of theft, burglary or fencing is 12% more likely to be convicted again of theft, burglary or fencing compared to an individual with no earlier conviction for these crimes (col. 4). Likewise, after his first incarceration a convict of drug-related offences is 11% more likely to get a new conviction for drug-related offences than an inmate with no previous record of drug crime (col. 5). Moreover, the average of the off-diagonal coefficients, i.e. criminal history in the other six types of offence, is close to zero in each column and always smaller than the diagonal coefficient.

[**Table 2** about here]

Therefore, similar to Bayer et al. (2009) we find suggestive evidence to confirm the relevance of studying the role of peer effects on crime *specialisation.* In other words, due to gains from crime specialisation and within-crime-field network sorting, we do not expect inmates to acquire *new* criminal capital due to exposure to experts with other crime fields of specialisation during incarceration (Hypothesis I), but we expect inmates to *strengthen* their criminal capital due to exposure to experts in their own crime field of specialisation (Hypothesis II). We refer to the first type of peer influence as an *introductory peer effect* and the second type of peer influence as a *reinforcing peer effect*.

Based on those results and the general theories of social interactions, we then formulate two competing theories about how exposure to experts in the inmate's own crime field *strengthens* criminal capital. For both theories, we posit that due to gains from crime specialisation and the homophily principle inmates tend to interact more with inmates with similar crime field of specialisation, age and ethnicity. As a consequence, in the prison context we expect peer influence

on future criminal behaviour from inmates with similar crime field of specialisation, age and ethnicity.

The first theory builds on the ideas of existing theoretical model of social norms spillovers ("role models", "social influence")[21] and prisonization theories. It postulates that: "*Exposure to experts in their own crime field of specialisation strengthens inmates' criminal identity as that type of criminal and increases the probability of recidivism with that type of crime*" (Theory 1). This first theory thus focuses on *crime-specific* conveyance of norms and culture that are in opposition to the norms and culture of the society.

The second theory argues that reinforcing peer effects might operate in prison via the mechanism behind theoretical models on social information/network spillovers ("social learning", "network as resources")[22] and similar theories applied to the prison context. Those latter theories discuss that incarceration implies propinquity with other criminals, which leads to opportunities for exchanging knowledge on how to commit crime (Hagan and McCarthy, 1997) and planning future co-offending (Reiss and Farrington 1991). Given returns from crime specialisation, inmates should then sort with peers from whom they can gain valuable information to become successful criminals and with whom they can form criminal networks and plan future joint crimes. Naturally, criminal networks and planning are not necessary for all types of crime. On this basis we then develop our second theory: "*For crimes requiring specific criminal capital* (that is crime-specific skills, e.g. knowledge transmission of how to commit property crime or deal and smuggle drugs without getting caught in the act)*, illegal networks, planning* (e.g. fencing and illegal drug trafficking, robbery) *and/or offences that are more "effective" when committed in groups* (e.g. threats, vandalism)*, exposure to experts in the inmate's own crime field of specialisation increases his gains from further specialisation in that type of crime and reinforces recidivism within this field*" (Theory 2).

Note that our two competing theories on how inmates strengthen criminal capital behind bars lead to two different predictions, which we will test empirically. Theory 1 predicts that a reinforcing peer effect exists for all crime fields of specialisation, whereas Theory 2 predicts that a reinforcing peer effect only exists for crimes that require specific criminal capital, illegal networks and/or some organisation of a group.

[21] See the theoretical models by Akerlof (1980) and Benabou and Tirole (2011).
[22] See theoretical models by Banerjee (1992) and Bikhchandani et al. (1992).

3.2 *Studying Peer Effects*

The estimation of peer effects implies several challenges for identification. The most common model considers an individual *i*'s outcome (Y_i) a function of individual characteristics (X_i), peers' average characteristics ($\overline{X}_{-i}$), and peers' average outcome ($\overline{Y}_{-i}$). ε is the error term. This model, also known as the linear-in-means model, can formally be written as:

$$Y_i = \theta + \varphi_1 * \overline{Y}_{-i} + \omega_1 * X_i + \omega_2 * \overline{X}_{-i} + \varepsilon_i \ . \quad (2)$$

The work of Manski (1993) highlights the *reflection problem* that arises in closed networks when studying peer effects in Eq. (2) with simple OLS regressions. This issue typifies as the outcome of each group member *i* potentially affects the outcome of the rest of the group *–i* (*endogenous effect*) and, thus, reverse causality may exist between Y_i and $\overline{Y}_{-i}$). This endogenous effect may be accompanied by what Manski (1993) calls an *exogenous effect*, or the effect of average peer's characteristics. The endogenous effect and the exogenous effect make it difficult to distinguish the effect of average peers' outcome, φ_1 in Eq. (2), from the effects of average peers' characteristics, ω_2 in Eq. (2), since peers' characteristics determine peers' outcome. An additional identification problem relates to the difficulty of eliminating potential bias from selection into the group.

3.3 Model and Identification Strategy

In the previous subsection we developed two competing hypotheses to posit if and how peer effects on crime operate in prison: no introductory peer effects (Hyp. I), but reinforcing peer effects (Hyp. II), either for all types of crimes (as predicted by our first theory) or only for crimes that require specific information, criminal networks or groups (as predicted by our second theory). In this subsection, we introduce the empirical model we use to test these two hypotheses. This model deals with the identification issues just described in several ways. First, strong functional form assumptions are necessary to eliminate the reflection problem. Similarly to previous works, e.g. Bayer et al. (2009) and Corno (2015), we assume that φ_1 is zero, i.e. peer effects take place through interactions within the group only due to peers' characteristics rather than subsequent peer outcomes. Therefore, we do not include a measure of peers' average outcome ($\overline{Y}_{-i}$) on the right-hand side. Furthermore, we only look at young individuals that are incarcerated for the first time and thereby eliminate the possibility that estimates of peer effects reflect peer effects from previous incarcerations.

Second, we deal with possible selection into prison by inserting facility-by-prior-offence fixed effects in our specification.[23] We then identify the effects of exposure to peers with a criminal history in offence *h* on *i*'s probability of recidivism with offence *h* from the random variation in the duration of sentence-serving overlap between *i* and each inmate with background *h* in a facility.

For this strategy to be valid, first, some within-variation of peer composition within prisons should be observed, and such variation should be uncorrelated with individual characteristics. We test this condition and report the estimates in **Table 3** (see Section 4). Once we account for facility-by-prior-offence fixed effects and using a standard 5% significance level, we do not find any significant correlations between the weighted share of peers with a criminal past in offence *h* and recidivism with offence *h* predicted by individual and municipality characteristics. The validity of our identification strategy is also conditional on the close-to-randomness of the timing of assignment of individuals with respect to the other inmates' characteristics. In other words, the presence of a criminal trend in the sample period would undermine the validity of our results. Although a simple test does not show strong systematic evidence of trends in criminality, we include quarter-of-release fixed effects to rule out any time trend. Formally, we apply the following model as our baseline specification:

$$R_{ijt}^{h} = \beta_0\left(Offense_{ijt}^{h} * peer_{ijt}^{h}\right) + \beta_1\left(No\_Offense_{ijt}^{h} * peer_{ijt}^{h}\right) + \alpha P_{ijt} + \gamma X_{ijt} + \lambda_j + Offense_{ijt}^{h} * \mu_j + \eta_t + \varepsilon_{ijt}^{h} . \quad (3)$$

R_{ijt}^{h} equals 1 if a young criminal *i*, first-time incarcerated in prison *j* and released at date *t*, recidivates with (i.e. is convicted of) offence *h* (*h* = 1, …, 7) within 12 months after release. In the baseline specification, the vector $peer_{ijt}^{h}$ measures individual *i*'s exposure to peers with experience in offence *h* according to Peer Definition I (all-age inmates) or Peer Definition II (inmates younger than 26). According to our two hypotheses, the effect of relative exposure to co-inmates with a criminal background in *h* would affect indviduals' risk of recidivism with *h* differently depending on whether they have prior experience with crime *h* or not. To capture the differential effects of relative exposure to peers with a criminal background in *h*, we allow for peer effects on crime-specific recidivism to vary with prior experience with offence *h* by interacting our explanatory variable $peer_{ijt}^{h}$ with $Offense_{ijt}^{h}$ and, alternatively, $No\_offense_{ijt}^{h}$. $Offense_{ijt}^{h}$ is 1 if individual *i* has committed an offence of type *h* before the first incarceration and zero otherwise, while

[23] Similar fixed effects are used in Bayer et al. (2009). Our interviews with the DPPS have allowed us to identify the most decisive criteria used to assign young offenders to a particular prison such as age, residence location and family situation, which we control for. Moreover, we have learned that young criminals were more likely to be randomly assigned to prisons in our sample period compared to today.

$No\_offense_{ijt}^{h}$ is 1 if individual i has no recorded history of offence h and zero otherwise.[24] The coefficients of those two interactions, i.e. β_0 and β_1, respectively, are the parameters of interest. β_0 is the effect of the weighted share of peers with experience in offence h on the individual's probability of recidivism with offence h, given that the individual is experienced with offence h, i.e. the *reinforcing* peer effect. To test whether exposure to peers with experience in offence h increases the probability of recidivism with an offence h for individuals with no prior experience with offence h, we also estimate β_1, i.e. the *introductory* peer effect. P_{ijt} and X_{ijt} capture, respectively, weighted peer and individual characteristics such as age, gender, ethnicity, family situation, whether the person had completed high school at the time of incarceration, and criminal histories in all seven types of offences h.[25] The vector $Offense_{ijt}^{h} * \mu_j$ captures facility-by-prior-offence fixed effects and λ_j represents facility fixed-effects. The vector η_t accounts for possible time trends and represents dummies for each quarter of release and ε is the error term. To investigate whether inmates sort into groups in prison, first we use the narrower peer definitions presented at the end of Section 2.1 instead of Peer Definitions I and II. Second, we conduct pairwise comparisons of peer effects due to the two baseline peer groups and peer effects due to the narrower peer definitions by applying the following model to our data:

$$R_{ijt}^{h} = \beta_0\left(Offense_{ijt}^{h} * peer_{ijt}^{h}\right) + \beta_1\left(No_{offense}{}_{ijt}^{h} * peer_{ijt}^{h}\right) +$$
$$\beta_2\left(Offense_{ijt}^{h} * peerN_{ijt}^{h}\right) + \beta_3\left(No_{Offense}{}_{ijt}^{h} * peerN_{ijt}^{h}\right) +$$
$$\alpha P_{ijt} + \gamma X_{ijt} + \lambda_j + Offense_{ijt}^{h} * \mu_j + \eta_t + \varepsilon_{ijt}^{h}, \qquad (4)$$

where $peer_{ijt}^{h}$ and $peerN_{ijt}^{h}$ represent two different peer definitions: one more general and one narrower definition. β_0 and β_2 are estimates of *reinforcing* peer effects. β_1 and β_3 are estimates of *introductory* peer effects. We estimate Equations (3) and (4) for seven crime categories simultaneously using a seemingly unrelated regression (SUR) framework.

[24] Similar to Bayer et al. (2009), we argue that any history of crime of type h must be accounted for as opposed to the most recent crime only, as—especially young—criminals might be incarcerated not only as a result of their most recent criminal activity but also due to a longer criminal history.

[25] See Appendix Table A1 for an overview of the variables included in the baseline specifications. Information on employment status at the time of incarceration is available to us, but we decide to disregard this variable because of its obvious endogeneity with incarceration and recidivism.

4. Results

4.1. Baseline Specification

Before we present the empirical results from the baseline specification (Eq. 3), we test the validity of our identification strategy in **Table 3**.

We identify peer effects from the variation in two inmates' incarceration spell overlap. This variation is random if our interacted peer share measures $\left(Offense_{ijt}^{h} * Peer_{ijt}^{h}\right)$ and $\left(No\_Offense_{ijt}^{h} * Peer_{ijt}^{h}\right)$ are unrelated to individual characteristics within a facility (cond. 1) and if criminal behaviour of young delinquents is not influenced by any criminal trend over time (cond. 2). We account for cond. 2 by including dummies for each quarter of release for each individual.[26] To test cond. 1 we first construct a predicted indicator for recidivism with offence *h* that summarizes individual determinants of recidivism with offence *h*, using individual and municipality characteristics and facility fixed effects. Next, we regress this indicator on the interacted peer measures with and without facility-by-prior-offence fixed effects for both Peer Definition I (all peers) and II (peers under age 26). Without facility-by-prior-offence fixed effects (top panel), the interacted peer measures are in most cases significantly correlated with the individual characteristics used to construct the predicted indicator of recidivism, although the coefficients are small. Put differently facility assignment is not free of selection and thus calls for a better strategy to identify peer effects. When we add facility-by-prior-offence fixed effects (bottom panel) and thereby account for systematic assignment of certain types of convicts into certain facilities, the coefficient estimates of the interacted peer composition measures turn insignificant at the 5-percent significance level in 21 out of 28 cases, and the magnitude of all estimates is very close to zero. Cond. 1 is thus satisfied; the inclusion of facility-by-prior-offence fixed effects allows us to identify peer effects from the random variation in the incarceration overlap of two inmates.

[**Table 3** about here]

We then test Hyp. 1 and Hyp 2 and report our estimates of the *reinforcing* peer effects and the *introductory* peer effects on recidivism within 12 months after release in **Table 4**. In Panel A we present the baseline results using Eq. (3) and Peer Definition I: all inmates. The first row shows our estimate of the reinforcing peer effect β_0 for each of the seven types of crimes. The estimate is positive and significant for two types of crimes: drugs offenses (4.3 pp.) and threat offenses (5.3 pp.). It is insignificant for the other types of crimes, except for robbery for which the estimate is negative and significant suggesting a dissuading peer effect for robbery. We report our estimate of

[26] Alternatively, we use a dummy for each quarter of incarceration. Results (available upon request) are very similar.

the introductory peer effect β_1 for each of the seven types of crime in the second row. All estimates are insignificant using the conventional 5% significance level.

The results presented in **Table 4**, Panel A, can be criticised on the grounds that they rely on the strong assumption that young inmates have as much social interaction with all co-inmates, irrespective of their demographic differences. This assumption violates the well-documented homophily principle in social network formation, i.e. individuals' preferences for connecting with similar people.[27] Also in a criminal context, as the findings of Damm and Dustmann (2014) show, the transmission of criminal capital or identity is more likely between delinquents and individuals alike in terms of, e.g., age and ethnicity. To take into account that young inmates are likely to sort into networks within the prison in terms of similar age, in Panel B we report our estimates of reinforcing and introductory peer effects limiting the peer group to co-inmates below age 26 in Eq. (3). Using this age-delimited peer definition we still find a positive and significant estimate of reinforcing peer effects only for drug offenses and threats and insignificant estimates of introductory peer effects for all types of crimes.

Next, we test empirically which of the two definitions is the best definition of young inmates' peers during incarceration. We do so by including the age-limited peer definition jointly with the all-age peer definition, i.e. estimating Eq. (4) with both Peer Definition I and II. We report our estimates of reinforcing and introductory peer effects using this specification in Panel C.

As Panel A and B, Panel C shows significant evidence of reinforcing peer effects for drugs and threats. In contrast to threat crimes, we find stronger reinforcing peer effects on drug crime after limiting the peer group to young co-inmates. This finding suggests that young first-time incarcerated drug offenders are more influenced by other young rather than older drug offenders, while young first-time incarcerated threat offenders are equally influenced by other threat offenders – young or older. As in Panel A and B, all estimates of introductory peer effects in Panel C are insignificant at a 5% significance level. Moreover, the dissuading effect for robbery found in Panel A and B turns insignificant in Panel C.

Irrespective of the peer definition **Table 4** depicts robust reinforcing peer effects for two of the seven types of crime: drug crimes and threats.[28] As we posited in the previous section, drug crimes and threats are offenses that imply specific attributes such as criminal capital or network to

[27] See e.g. McPherson et al. (2001) for an overview of the principle's significance for social networks formation.

[28] We estimate Eq. (3) with the full set of controls and fixed effects for 12 crime-specific recidivism indicators with OLS. Results are shown with all control variables in Table A7. Those estimates also show a positive and significant reinforcing peer effect for drug-related recidivism.

be effective. Exposure to other criminals in the field in prison may thus provide access to those attributes. However, we do not find evidence of reinforcing peer effect for other types of crime that also require specific attributes. Further, irrespective of the peer definition we find no evidence of introductory peer effects. This finding aligns with the logic of crime specialisation behind the previously validated Hyp. 2. Therefore, for the sake of simplicity we only report estimates of reinforcing peer effects in the rest of the paper.

[**Table 4** about here]

4.2. Network sorting

Ideally, researchers would link the admin crime records with inmates' self-reported information on peers to capture the actual peer group in prison. Unfortunately, a mapping of social networks does not exist for inmates in Danish prisons. Thus we test our hypotheses about whether and how peer effects operate in prison by further delimiting the peer group of young inmates by ethnic origin (Western, including Danish, origin or non-Western immigrant origin) and county of residence prior to incarceration.[29] To investigate whether young inmates sort into finer networks within prisons in terms of same ethnic origin or same region of origin in Denmark, we use these narrower peer groups alone as in Eq. 3 and jointly with one of our two broader peer definitions (peer def. I or II) as in Eq. (4).[30] The results are shown in **Table 5**. For comparison purposes we repeat the baseline results in Panel A and Panel D.

[**Table 5** about here]

When studying the impact of narrower peer groups, we still find significant evidence for reinforcing peer effects only for drugs and threats and no significant introductory effects.[31] For drug offenders we also find a significant estimate of the reinforcing peer effect when we define the peer group as co-inmates with similar ethnic origin (Panel B and Panel E). By contrast, the estimate of the reinforcing peer effect for threats turns insignificant when we use narrower definitions of the peer group.

As the results in Panel H show, when we include the weighted shares of co-inmates with experience with crime *h* using both the relatively broad peer definition of young peers (def. II) and the narrower peer definition of same ethnic origin young peers we find a positive significant

[29] In our observation period, 1994-1997, Denmark was divided into 15 counties.

[30] For simplicity we do not show the validity test of our identification strategy (similar to the test in Table 3) for each alternative peer group definition. The identification strategy remains valid. Results are available upon request. See **Table A2** for summary statistics on the alternative peer group definitions.

[31] Our estimates of introductory peer effects using narrow peer definitions are available upon request.

reinforcing peer effect on recidivism with drug offenses due to both peer groups. This provides empirical evidence that young co-inmates of the same ethnic origin with experience with drug crime have a stronger (negative) influence on recidivism of young first-time drug offenders than young co-inmates with drug crime experience in general. This finding suggests that young drug offenders sort into networks in prison in terms of both age and ethnic origin. By contrast, we find no evidence that young offenders sort into networks with co-inmates from the same geographic location prior to incarceration.

5. Undetected crimes

If detected crime only constitutes a fraction of actually committed crime – on average 20 % in Denmark over the 1986-1998-period (Statistics Denmark, 1986-1999) – in effect we estimate prison peer effects on *detected* recidivism. This is problematic since according to our second theory reinforcing peer effects may operate in part through the transmission of crime-specific capital, e.g. learning how not to be caught in the act of crime. In this section we exploit some unique attributes of the Danish registers to deal with the imperfection of crime detection and re-test our two hypotheses taking this problem into account.

5.1. Stupid versus clever co-inmates

We think of clever (as opposed to stupid) co-inmates as the subgroup of co-inmates who are able to teach fellow inmates how not to be caught in the act of crime. With our admin data the easiest way to distinguish between stupid and clever co-inmates is to use the information about whether inmates have completed an upper-secondary education. In Denmark, upper-secondary education is either a general upper-secondary degree that qualifies a student for enrolment in tertiary education or a vocational education that prepares a student for a skilled job. Therefore, we empirically distinguish the influence of stupid co-inmates from the influence of clever co-inmates on first-time incarcerated young offenders' risk of recidivism for each of the two baseline peer definitions – co-inmates of all ages (Peer Definition I) and co-inmates under age 26 (Peer definition II). To do so we construct the following sub-group definitions: inmates who did not complete an upper- secondary education (thereafter "uneducated peers" or "dropouts"), and inmates who completed an upper-secondary education (thereafter "educated peers"). We expect to find more evidence of reinforcing peer effects on recidivism limiting the peer group to "dropouts" compared to "educated peers". We present the estimates of Eq. (3) using these narrower peer definitions ("dropouts" and "educated peers") with no age limit and with age limit 25 in **Table 6**.

The results for uneducated peers in Panels A and C are in line with our prior and remain similar to our baseline results: the positive and significant reinforcing peer effects for drugs and threats are robust to delimiting peers to dropouts. By contrast, when limiting the peer group to educated co-inmates below age 26 (Panels B and D), we find no significant evidence of reinforcing peer effects for drugs and threats. But, unexpectedly, we find significant evidence of reinforcing peer effects for theft, burglary and fencing due to exposure to *educated* young co-inmates (Panel D). Moreover, by comparison with the baseline results we see that the dissuading effect for robbery reported in Table 4, Panels A and B, runs through exposure to *educated* co-inmates who have committed robbery (Panels B and D).

Moreover, we estimate Eq. (4) using "dropouts" or "educated peers" jointly with one of our broad peer definitions (Peer def. I or II) and report the peer effects estimates in Panel E to G in **Table 6**. Using all inmates as the broad peer definition, our baseline results of reinforcing peer effects on drug crimes and threats remain. However, for these two crime categories we also find suggestive evidence of an additional reinforcing peer effect due to exposure to uneducated inmates (although the estimate lacks statistical precision), indicating that uneducated co-inmates who have been convicted of drug crimes (threats) have a stronger influence on the risk of repeat-offending with drug crimes (threats) compared to all co-inmates who have been convicted of drug crimes (threats) (Panel E). Similarly, compared to young inmates who have been convicted of threats the results in Panel G suggest that uneducated young inmates with experience in threats have a stronger influence on the risk of repeat offending with threats. By contrast, for drug crimes and threats the estimates of the reinforcing peer effects using educated peers as the narrow peer definition are virtually zero, suggesting no additional effect on the risk of repeat offending with drug crimes (threats) due to exposure to educated co-inmates among co-inmates who have been convicted of drug crimes (threats). This exercise also reveals a positive and significant reinforcing effect for robbery due to exposure to dropouts who have been convicted of robbery (Panels E and G), and we still find the positive and significant reinforcing peer effect for theft, burglary and fencing due to exposure to educated young co-inmates (Panel H).

[**Table 6** about here]

A slightly more data-demanding way of distinguishing stupid co-inmates from clever co-inmates is to exploit the admin information about co-inmates' past incarceration spells (available from 1991 and onwards) to differentiate between "novice" and "hard" criminals, where hard criminals are defined as co-inmates who have spent more than 180 days in prison (since 1991). Compared to

novice criminals, hard criminal co-inmates may be more likely to continue a criminal career, have more knowledge of future opportunities for crime in their area of expertise, have better illegal contacts increasing the return to future crime and be responsible for the planning of joint crimes to be committed post-release. 24% (20%) of all (young) co-inmates fall into this category (**Table 1**). We expect to find stronger reinforcing peer effects on recidivism due to exposure to hard criminals than criminals in general.

In **Table 7** we estimate Eq. (3) departing from these two narrow definitions of peers (hard criminals among all co-inmates and hard criminals among young co-inmates, Panels A and D). In addition, we estimate Eq. (4) using both the hard criminal peer definition and the relevant broad definition (Peer def. I or II), see Panels G and I. The results for drugs are in line with our prior: young hard criminals have a stronger (negative) influence on recidivism of first-time incarcerated young drug offenders than young inmates in general (Panel I). This is not the case for threats. Furthermore, when delimiting the peer group to hard criminals we find a positive and significant reinforcing peer effect on vandalism and arson (Panel A).

We further distinguish the two afore-constructed groups into two sub-groups of (young and all-age) hard criminals: stupid and clever. We think of clever hard criminals as those who are the "big fish" in crime networks or the masterminds of joint crimes post-release and have good, but not perfect, knowledge about how *not* to be caught in the act of crime in contrast to stupid hard criminals who are "small fish" habitual offenders and tend to be caught in the act of crime. On average 74% (76%) of (young) hard criminals among fellow inmates fall into the category of stupid (young) hard criminals, representing on average 18% (15%) of (young) co-inmates. Since we estimate peer effects on detected recidivism, we expect to find stronger reinforcing peer effects due to exposure to stupid hard criminals than clever hard criminals. We estimate Eq. (3) using the "stupid hard criminal" or "clever hard criminal" peer definition and Eq. (4) using the "stupid hard criminal" peer definition together with the respective broad definition (Peer def. I or II). We report the resulting peer effects estimates in Panels B-C, E-F in **Table 7**. As expected, we find stronger evidence of reinforcing peer effects using the "stupid hard criminal" peer definition compared to the "clever hard criminal" definition, especially for vandalism and arson (Panels B and E). Moreover, our baseline results of reinforcing peer effects for drugs and threats are robust to inclusion of weighted shares of peers convicted of crime *h* among "stupid hard (young) criminals" (Panel E).

[**Table 7** about here]

In sum, the results in **Table 6** and **Table 7** show that by delimiting the peer group to "stupid" co-inmates among all-age (young) inmates or all-age (young) hard criminals, we are able to uncover reinforcing peer effects on recidivism with robbery and with vandalism and arson. Moreover, our baseline results of reinforcing peer effects for drugs and threats are robust to inclusion of weighted shares of peers convicted of crime *h* among "stupid hard (young) criminals". In addition, we find evidence of reinforcing peer effects on recidivism with theft, burglary and fencing and a negative reinforcing peer effect on recidivism with robbery due to exposure to educated young co-inmates who have expertise in that crime field. The latter finding has two interpretations: either young educated co-inmates who have been convicted of robbery discourage other young co-inmates from recidivism with robbery, or they teach other young co-inmates in their crime field of specialisation how not to be detected. Seen through the lens of our hypotheses, the analyses in **Table 5**, **Table 6** and **Table 7** show that we cannot reject Hyp. 2: reinforcing peer effects on recidivism. But note that our results thus far show no evidence of reinforcing peer effects for two types of crimes: violence and sexual offenses as well as weapon offenses. In the next subsection we will exploit another feature of our admin crime records to address the problem that the crime detection rate is far from 100%.

5.2. Prison peer effects in the short- and medium-run

Thus far we have estimated prison peer effects on detected recidivism within 12 months after release. Since the chances that a crime committed post release remains undetected decrease with time since release, in this subsection we investigate prison peer effects on recidivism using a longer time horizon since prison release. To evaluate the peer effects at the extensive margin we re-estimate Eq. (3) using new dependent variables: an indicator for being convicted of offence *h* within 24 or 36 months after prison release. We use most peer group definitions related to Peer Definitions I (all-age peers) and II (young peers): (young) peers, (young) hard criminals, (young) dropouts, and (young) educated peers. We report estimates of reinforcing peer effects in columns (1)-(7) of **Table 8**. We recall the baseline estimates for recidivism within 12 months in Panel A and report the estimates on recidivism within 24 (36) months after prison release in Panel B (Panel C).[32] To fully understand the consequences of the reinforcing peer effects found on recidivism on the future criminal career of a first-time incarcerated young individual, we also evaluate peer effects on the

[32] In an earlier version of the paper we also considered recidivism within 6 months (at the extensive margin only). We find reinforcing peer effects on recidivism with drugs but given the short time for new judgements to fall, we prefer using a minimum of 12 months.

intensive margin, i.e. using the *number* of new convictions of offence *h* within 12 months, 24 months or 36 months as the dependent variable in Eq. (3). We report our estimated peer effects at the intensive margin in columns (8)-(14) of **Table 8**.

Increasing the time span of recidivism yields at least five notable results. First, the magnitude of the estimated reinforcing peer effects on drug crime increases with the time horizon (col. 5). The reinforcing peer effects from all-age peers, young peers, young hard criminals and (young) dropouts, particularly, remain significant up to 36 months after release. If we instead assess reinforcing peer effects on drug crime at the intensive margin (col. 12), we obtain significant estimates for the same peer groups and interestingly the estimates increase over time. In other words, exposure to other drug criminals not only augments chances for the reiteration of drug crime but also the number of drug offences after release.

Second, while the reinforcing peer effect on threat crime within 12 months is significant for most peer groups (col. 7 and 14, Panel A), it subsists only up to 24 months. This effect is driven by exposure to all-age peers and all-age dropouts with a background in threat crimes. Moreover, exposure to, especially, uneducated threat offenders increases the number of new convictions with threats with time (from 12 to 24 months).

Third, the reinforcing peer effect of relative exposure to hard criminals with a background in vandalism and arson on recidivism with vandalism and arson persists up to 36 months, increases in magnitude over time (col. 3) and also augments the number of new offences with vandalism over time (col. 10).

Fourth, **Table 8** shows that the dissuading peer effect on recidivism with robbery (col. 2 and 9) for all-age peers and young peers (driven by exposure to educated peers) who have been convicted of robbery continues to operate up to 36 months. The reinforcing peer effect on recidivism with theft, burglary and fencing (col. 4, Panel A) due to interactions with young educated criminals become imprecisely estimated after 12 months.

Fifth, we find evidence of another dissuading peer effect from several peer groups on violent and sexual offences (col. 1 and 8). This positive peer influence on recidivism with violence persists over time.

[**Table 8** about here]

6. Mechanisms

In this section we explore the possible channels through which reinforcing peer effects on recidivism with robbery (due to exposure to uneducated peers convicted of robbery, Table 6, Panels E, G), vandalism and arson, theft, burglary and fencing, drugs and threats operate in prison and provide a possible explanation for the negative reinforcing peer effect on recidivism with violent and sexual offenses.

6.1. Prison peer effects by incarceration length and prison type

In Section 3 we proposed two theories on how reinforcing peer effects on crime-specific recidivism may operate in prison. According to our first theory "*Exposure to experts in their own crime field of specialisation strengthens inmates' criminal identity as that type of criminal and increases the probability of recidivism with that type of crime*". Alternatively, reinforcing peer effects in prison may operate through the following channel: "*For crimes requiring specific criminal capital, illegal networks, planning and/or offences that are more "effective" when committed in groups, exposure to experts in the inmate's own crime field of specialisation increases his gains from further specialisation in that type of crime and reinforces recidivism within this field*". We believe that, irrespective of which channel is at work, the reinforcing peer effect increases with time spent behind bars because inmates have more time to i) sort into networks within prisons in terms of crime field of specialisation as well as demographic characteristics and ii) interact with fellow co-inmates. Therefore, we investigate empirically whether the baseline reinforcing peer effects for drug crimes and threats (found in Table 4) are stronger for the sub-group of individuals in our sample who spend relatively long time behind bars. In particular, we extend the model in Eq. (3) by including an interaction term between each peer definition and a dummy for being in the highest 75 percentile of the duration distribution (i.e. more than 30 days). In Appendix **Table A4** we present the estimates of reinforcing peer effects from the extended model using peer definitions I and II. Since the length of prison sentences are not randomly determined but, by law, depends on the severity (costs) of the crime the estimates in Appendix **Table A4** should not be given causal interpretation. For drug crimes and using peer definition II (which we found is the most appropriate peer group for young inmates convicted of drug crimes, **Table 4**), the point estimate of the reinforcing peer effect is – as expected – larger for inmates with relatively long prison stays. By contrast, for threats and using peer definition I (which we believe to be a better peer definition for inmates convicted of threat crimes, **Table 4**), the point estimate of the reinforcing peer effect is

lower for inmates with relatively long prison stays. Interestingly, **Table A4**, Panel A, also provides evidence that the dissuading peer effect on recidivism with violent and sexual offenses found in **Table 6**, Panels B and F, and **Table 8**, are driven by the sub-group of inmates in our sample who serve relatively long time in prison.

We speculate that this dissuading peer effect on recidivism with violent and sexual offenses for inmates with relatively long prison spells is due to their higher rates of participation in anger-management programmes and cognitive behaviour therapy compared to violent convicts with relatively short sentences; such programmes may exert positive and long-lasting peer effects on reducing future violent behaviour. Traditionally, the Danish Prison and Probation Service has focused on rehabilitating and counselling offenders with relatively long prison sentences (Landersø, 2015, Ch. I). Before 2006 there were no official guidelines for Danish prisons on rehabilitation programmes for short sentences. Unfortunately, prior to 2006 we lack documentation on in-jail rehabilitation for offenders who only served one or two months in jail.[33] Minke (2010) presents the most thorough documentation of the inmates' conditions in Denmark through her survey from 2007-2009 among nearly half of the Danish prison population (in 12 out of 16 prisons). We present her results on the reported rates of participation in rehabilitation programmes (including: treatment for drug or alcohol abuse, anger management therapy and cognitive behaviour therapy) by time spent in prison in **Table A6**. The table shows that participation rates in rehabilitation programmes increase with incarceration length. Around 20% of the survey participants who had been incarcerated for less than one month and more than 50% of the survey participants who had been incarcerated for three months or more participated in rehabilitation programmes.

Furthermore, for a given length of prison spell, reinforcing peer effects are likely to be stronger in prisons where inmates spend more hours with fellow inmates every day (in contrast to prisons where inmates spend more time in social isolation in the cell or with people outside the prison). In contrast to closed and local prisons, open prisons seek to mimic a highly structured everyday life where inmates have mandatory chores such as manual or vocational labour and also cook their own meals (Landersø, 2015, Ch. I), thereby increasing the level of social interactions within and across sections in the prison.[34] On the other hand, as mentioned in Section 1, inmates in

[33] After 2006, all incarcerated offenders are entitled to an interview with a case officer at the time of prison admission. The Danish Prison and Probation Service cannot specify the content of the admission interviews but incarceration length obviously limits the type of in-jail rehabilitation that can be put into effect (Landersø, 2015, Ch. I).

[34] Some offenders in our sample serve their longest spell in a local prison (if custody exceeds their actual sentence). The local prisons of Copenhagen, in particular, are characterised by similar security and monitoring practices than closed prisons (DPPS, 2013). In the paper we categorise Copenhagen's local prisons as closed prisons.

open prisons are allowed to have regular contact with their families and leave the prison during the day in order to attend school, work or rehabilitation and therefore have few interactions with other inmates.

We examine whether peer effects vary with the type of facility (closed, open or local prisons) by extending Eq. (3) to allow peer effects to vary by prison type. Due to likely unobserved characteristics related to individuals' selection into closed facilities, these estimates should not be interpreted as causal effects of prison type on the strength of reinforcing peer effects (and are only shown in the Appendix **Table A5**). The coefficient estimates in the first row are the estimated reinforcing peer effects for inmates who serve time in an open prison (reference category). The estimates in the row two (three) are the estimated reinforcing peer effect for inmates who are incarcerated in a closed (local) prison.

For all crime types the point estimate of the reinforcing peer effects on recidivism is larger for the subgroup of individuals incarcerated in closed prisons than in open prisons.[35] Moreover, the positive and significant reinforcing peer effect on recidivism with threats is driven by individuals incarcerated in closed prisons. Further, in **Table A5**, for individuals who are incarcerated in local prisons we only find little evidence of reinforcing peer effects on vandalism and arson, theft, burglary and fencing, drugs and threats, possibly due to their short spells of incarceration – in line with the results in **Table A4**.

Summing up, the results in **Table A4** and **Table A5** suggest that reinforcing peer effects on crime are stronger for individuals with relatively long incarceration and for individuals in closed institutions characterised by higher monitoring levels, fewer possibilities for social interactions *outside*, and where peers typically have a heavier criminal record.

6.2. Co-offending with co-inmates after prison release

In this subsection we investigate a sub-channel through which reinforcing peer effects may operate in prison according to our second theory: the planning of co-offending post-release. Earlier works have shown that co-offending in general is more likely for burglary, robbery (Reiss and Farrington, 1991; Carrington, 2009) and to some extent drug offences (Roxell, 2011). Yet little is known about the factors behind co-offending (Carrington, 2009; McGloin and Nguyen, 2012) and there is even less evidence on joint crime involving previous prison inmates. The Danish registers contain an

[35] In our sample, inmates in closed prisons have a higher probability to recidivate with drugs, 15% of the individuals in closed prisons in the sample are earlier drug convicts (against 11% in the whole sample), and the shares of peers with past drug convictions is also higher (12% vs. 9% in the whole sample).

identifier of both a convicted person and his judiciary case, and thus we investigate the extent to which several former prison fellows are attached to the same case (i.e., co-offending).

To our knowledge Roxell (2011), using Swedish data, is the only register-based empirical study of co-offending with previous co-inmates. In line with her findings we find that although co-offending after prison is quite common for individuals in our sample (36%), especially for burglary, theft and fencing crimes (21%), co-offending with previous prison fellows is a rare event. Indeed, only 2% are convicted for a joint crime with earlier prison fellows before the end of our observation period (2006). Of the 2%, 57% are jointly convicted of theft, burglary and fencing and 13% of robbery, while almost none are jointly convicted for drug crime or any of the other types of crime. We thus conclude that the reinforcing peer effects cannot be entirely explained by the planning of joint crime in prison post-release.[36]

7. Discussion and Conclusion

In this paper we ask whether inmates build up or strengthen criminal capital while serving time in prison due to peer effects. To answer this question we extract the population of young inmates incarcerated for the first time in a Danish prison from unique criminal and administrative registers for the entire prison population in Denmark over a ten year period. For this sample of inmates who are not (yet) habitual offenders we investigate peer effects on crime-specific recidivism using a strong empirical research design. We exploit the variation in time-serving overlap between each pair of inmates in a facility after including facility-by-prior-offence fixed effects and quarter-of-release fixed effects to deal with selection into prison.

In accordance with the homophily principle and gains from crime specialisation, we did not expect to find that inmates acquire new criminal capital during incarceration due to exposure to experts with *other* crime fields of specialisation (hypothesis I: no introductory peer effects), but rather strengthen their criminal capital due to exposure to experts in their *own* crime field of specialisation (hypothesis II: reinforcing peer effect).

[36] We speculate that this may be due to data limitations. The Danish crime registers may be ill-suited for identifying members of illegal distribution networks because even if, say, the dealer reveals the identify of his supplier under interrogation, the police may treat them as two separate cases because they face different charges since they are located at different places in the distribution chain. Moreover, the drug distribution chain and the networks involved in drug crime are typically wide with unsalient ties (Malm and Bichler, 2011), which makes it difficult for the Police to connect drug convicts to a common judiciary case. Therefore, the investigation of co-offending in organized crime based on crime registers alone may not be sufficient. Lindquist and Zenou (2014) use Police data on crime suspects and Malm and Bichler (2011) make use of several data sources.

Taking into account network sorting within prisons and the problem that only a fraction of crimes is ever detected, we find no evidence of introductory peer effects but strong evidence of reinforcing peer effects for four out of seven crime categories: i) drug crimes[37], ii) threats[38], iii) vandalism and arson, iv) theft, burglary and fencing, and some evidence of reinforcing peer effects on robbery (due to exposure to uneducated inmates convicted of robbery). By contrast, we find no evidence of a reinforcing peer effect for weapon crimes. Interestingly, for violent and sexual assault (robbery) we show a dissuading peer effect: the risk of recidivism with violent and sexual assault (robbery) decreases with exposure to (educated) inmates convicted for violent and sexual assault (robbery).

We formulate two competing theories to explain reinforcing peer effects in prison. On the one hand, reinforcing peer effects might operate in prison only for *crimes requiring specific criminal capital (crime-specific skills), illegal networks, planning and/or offences that are more "effective" when committed in group*. On the other hand, peer effects might operate in prison because *exposure to experts in one's own crime field of specialisation strengthens the inmate's criminal identity as that type of criminal and increases his probability of recidivism with that type of crime*. Our results lend support to the former theory of crime-specific knowledge transmission and network building in prison. By contrast, since we do not find evidence of a reinforcing peer effect for all crime types the latter theory of a social norm spillover is not likely to be an important channel for the operation of reinforcing peer effects in prison.

Turning to the dissuading peer effect for violent and sexual assault, further investigation shows that it is driven by a sub-group of individuals whose incarceration spell is relatively long. Minke (2010) documents that in Danish prisons, the rate of participation in rehabilitation programmes (e.g. anger management programmes and cognitive behaviour therapy) increases with the sentence length. We speculate that programmes entail positive peer effects for the group of convicted violent criminals who participated in such programmes and reduce their risk of recidivism with violence and sexual assault even more.

[37] A large part of drug criminals in our sample is convicted for drug possession, while a smaller part is convicted for selling or smuggling drugs. These two categories represent the most commonly used distinction in the Danish conviction registers for drug-related crime. In the Danish law, a drug-related offense punishable with imprisonment implies being part of a drug distribution network either in form of possessing, smuggling or selling drugs and is not justified by drugs consumption as such. Moreover, the longer their prison sentence, the more likely drug addicts are to receive rehabilitation (Minke, 2010). Therefore, our finding of a reinforcing peer effects on drug-related recidivism is unlikely to be driven by incarceration of drug addicts who consume drugs again after release.

[38] We speculate that threatening behaviour is more "effective" or impressive on victims when committed jointly. Note that only few individuals in the sample are convicts of threats (N=113), and this small number may hinder our chances to capture joint threat crime post release with a former prison fellow.

We also demonstrate the importance of the peer group definition for future peer effect studies. Indeed, we find that peers' influence on crime is particularly salient from fellows with similar ethnicity and age – in line with homophily theories. This is especially true for drug criminals. Interestingly, in her study based on a survey of inmates in Danish closed institutions Minke (2012) finds that inmates with a background in drugs are more likely to socialize with other drug convicts and be excluded from other inmates. More generally, the sorting of young criminals into groups of the same ethnicity accords with homophily theories and the evidence provided in other Danish crime studies (Damm and Dustmann, 2014; Bengtsson, 2012).

In addition, we show that exposure to, in particular, dropouts and ("stupid") hard criminals (in the individual's own crime field of specialisation) during imprisonment increases the risk of recidivism of first-time incarcerated young adults. The effect from uneducated peers and the non-impact of young educated peers make sense in light of the well-established negative relationship between schooling and crime (Lochner and Moretti, 2004; Machin et al., 2011) – i.e. uneducated drugs criminals stay in crime because they have fewer opportunities in the legal job market. Further, if offenders who spend relatively longer time in prison are also more likely to remain criminals – because of social and economic stigmatisation or harsh incarceration conditions (e.g. Becker, 1968; Kling, 1999; Chen and Shapiro, 2007; Holzer et al., 2003; Hutcherson, 2012) and thereby strengthen criminal capital, it is reasonable to expect that exposure to hard criminals will encourage the repetition of criminal behaviour among relatively new young criminals. Therefore, one interpretation is that dropouts and "stupid" hard criminals exert a stronger criminal influence on the criminal behaviour of first-time incarcerated young adults than educated/clever inmates. However, since we are estimating peer effects in prison on detected recidivism, an alternative story can be that we become more likely to detect peer effects when we delimit the peer group to inmates who – in contrast to educated/clever inmates – do not know how to commit crime that stays undetected.

We find mixed evidence of peer effects on recidivism with property crimes. First, we show in **Table 6** a reinforcing peer effect of 0.03 pp on "theft, burglary and fencing" due to the influence of young educated peers convicted of "theft, burglary and fencing" and a reinforcing peer effect of 0.114 pp on robbery due to the influence of school dropouts among fellow inmates convicted of robbery. Second, and quite interestingly, we find a robust and persistent *dissuading* peer effect on the reiteration of robbery especially from the influence of educated criminals too – although now irrespective of peers' age. One possible explanation of this finding might be that educated offenders are less prone to violence, implied in robbery, but more inclined to petty property crimes such as

theft or more organised crimes such as burglary and fencing. Moreover, as our investigation of co-offending shows, "theft, burglary and fencing" is the crime category that is mostly represented among crimes committed jointly with earlier prison fellows in our sample. However, given the small share of co-offending with former prison fellows in the sample the reinforcing peer effect on theft, burglary and fencing can only partly originate from the planning of joint crime.

Finally, it is worth highlighting that our analysis does not suggest that inmates influence the criminal behaviour of young inmates from the same area of residence before incarceration. For drug-related crimes, in particular, this nil finding might reveal that drug criminals from the same area avoid competing for the same market.

To better understand the magnitude of our findings we compare estimates of the reinforcing peer effects with coefficients of crime specialisation irrespective of peer effects (**Table 2**). For drug-related crime a standard-deviation increase in the number of drug convicts under age 26 in a facility (4.893) increases the likelihood of recidivism with drugs within 12 months for individuals with a history in drug crime from 15.5% (**Table 2**) to 15.7% (**Table 4**), i.e. by 0.2 percentage point or 1.3%. In terms of standard deviation the effect size remains very similar across peer group definitions (from 0.14 pp to 0.16 pp). For threat-related crime a standard-deviation increase in the number of all-age inmates with threat-crime records increases the likelihood of recidivism with threats within 12 months from 3.9% to 4.0%, i.e. by 0.07 pp or 2.6%, for individuals with a background in threat-related crime. Again, the reinforcing peer effect on threat-specific recidivism remains stable across peer group definitions (0.05 to 0.07 pp). The magnitude of the effect for the other types of reinforcing peer effects (i.e. on "theft, burglary and fencing" and on "vandalism and arson") is very comparable. The dissuading peer effect in prison from young robbery convicts with an upper-secondary education decreases the reiteration of robbery within 12 months by 0.08 pp – or by 2%.

Another useful way to interpret our findings is to place them next to the results of the most comparable study, Bayer et al. (2009). The authors study peer effects from incarceration in juvenile institutions with the same strategy and provide strong evidence of reinforcing peer effects for similar offences including drug-related crimes, petty larceny and burglary. However, in contrast to ours, their analyses also depict reinforcing peer effects on violent and sexual offences as well as

introductory peer effects on robbery. (Their study does not include threats as an explicit offence category.)

In terms of standard deviation our estimates of reinforcing peer effect are generally smaller. For instance, they find a 3-pp increase for the reiteration of drug crime, whereas we find a 0.2-pp increase. Differences in effect size may originate from significant differences between the two studies' population, context and data availability. First, our unique data allows us to extract a sample of relatively "novice" young criminals and investigate peer effects from inmates across age and experience groups, while Bayer et al. (2009) estimate peer effects among juveniles only. Juvenile and young adult criminals appear to have remarkably different recidivist behaviour. Indeed, Bayer et al. (2009) show a higher initial likelihood of crime specialisation conditioning on criminal history only (irrespective of peer effects as in Table 2): e.g. 29% for drug crimes in Bayer et al. (2009) vs. 15% in our study. Such gap makes sense in light of previous crime studies, which show that juvenile offenders are more prone to criminal behaviour than adult offenders. Reasons for this difference include that the youth tends to lack maturity to reflect on the consequences of crime (Moffitt, 1993; Pichler and Romer, 2011) and experiences less of an employment penalty since employers view them relatively as less culpable (Mears et al., 2007). Moreover, in Denmark the prison deterrence effect on recidivism might be lower for juvenile offenders since we learned that they tend to receive a less harsh punishment than young adults for the same crime (DPPS, 2013).

Second, in addition to juveniles, we exclude offenders with past imprisonment. We argue that focusing on the recidivism of first-time incarcerated offenders is informative, given that we intend to study the criminal influence of relatively more experienced inmates on the criminal behaviour of young people who are not (yet) habitual offenders. Hence, it is reasonable to expect young adults from our sample to show less of an offending behaviour compared to the population in Bayer et al. (2009). In addition, while Bayer et al. (2009) control for a rich set of demographic characteristics of the individuals in the sample and their peers, we control for an even richer set of demographic characteristics of both individuals and their peers.

Finally, another major difference between the two studies relates to their use of data from two greatly different contexts: Denmark and Florida. For example, the two settings are likely to differ in terms of monitoring practices, imprisonment conditions, anger management training, education and addiction treatments. Further, access to education, labour market and criminal opportunities are likely to be unique to each country.

Our findings bear some important implications for both future research on peer effects and policy makers interested in reducing crime.

In terms of contribution to the literature, we show new evidence on the presence and the nature of peer effects on the criminal behaviour of relatively less experienced criminal adults. From a methodological perspective, we furthermore demonstrate the importance of the peer group definition for the investigation of peer effects on crime: the homophily principle of grouping with similar others also applies to criminals' preferences to form groups (in order to commit joint crime, see e.g. van Mastrigt and Farrington, 2014). In addition, we show that co-inmates who are more habituated of incarceration and high school dropouts exert a stronger influence in terms of criminal behaviour, for instance for recidivism with vandalism and arson. Another contribution to the literature on peer effects comes from the development and discussion of hypotheses and theories to explain how peer effects operate in prison. In that respect we show robust support for a theory of crime-specific social information and network spillovers and less support for a theory of crime-specific transmission of deviant norms. By contrast, we do not find support for the acquisition of criminal capital related to unfamiliar offence categories in prison but solely for processes of further crime specialisation.

In terms of policy, our findings suggest that assigning convicts to prison by criminal background is likely to increase recidivism and, particularly, crime specialisation with most types of crime. Moreover, the exposure of relatively unexperienced young offenders to more experienced criminals in their own crime field of specialisation also reinforces criminal behaviour. Therefore, isolating hard criminals is likely to help reduce crime among young and relatively less experienced offenders. Quantitatively, the magnitude of the reinforcing peer effects are small, but in terms of the implied reduction in the social costs of crime the size of our estimates becomes more remarkable. Available estimates of the annual direct costs of law enforcement for illicit drug crime range from € 575 million in Spain, € 5 billion in the UK and $ 9 billion in the US (RAND, 2009, ONDCP, 2015). A decrease in 1% in drugs crime would then translate into an annual saving of half a million euros in the UK and close to a million dollars in the US, without even considering additional reduction in other costs such as treatment, prevention, drug-related death and productivity costs – a total estimated at $ 193 billion per year in the US by the U.S. Department of Justice (2011).

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8. List of Tables

Table 1: Summary statistics

	Mean	Std. Dev.	
		Overall	Within
Recidivism rates (at least once within 12 months upon first release)			
Overall	0.532	0.50	0.48
Violent and sexual offences	0.077	0.266	0.262
Robbery	0.021	0.144	0.142
Vandalism and arson	0.032	0.176	0.173
Theft, burglary and fencing	0.259	0.438	0.421
Drug-related offences	0.067	0.250	0.244
Weapons act	0.022	0.146	0.144
Threats	0.023	0.149	0.147
Other offences	0.231	0.422	0.413
Recidivism rates (at least once within 24 months upon first release)			
Overall	0.690	0.46	0.45
Violent and sexual offences	0.138	0.345	0.338
Robbery	0.040	0.197	0.194
Vandalism and arson	0.061	0.240	0.235
Theft, burglary and fencing	0.376	0.484	0.466
Drug-related offences	0.119	0.324	0.315
Weapons act	0.045	0.208	0.203
Threats	0.048	0.214	0.211
Other offences	0.372	0.484	0.475
Recidivism rates (at least once within 36 months upon first release)			
Overall	0.757	0.43	0.42
Violent and sexual offences	0.173	0.379	0.370
Robbery	0.055	0.229	0.225
Vandalism and arson	0.079	0.270	0.265
Theft, burglary and fencing	0.435	0.496	0.479
Drug-related offences	0.167	0.373	0.360
Weapons act	0.061	0.239	0.233
Threats	0.066	0.249	0.244
Other offences	0.447	0.497	0.488
Socioeconomic characteristics in the year of incarceration			
Male	0.951	0.216	0.188
Ethnic Dane	0.879	0.327	0.318
Married	0.002	0.039	0.038
Has at least one child under 6	0.096	0.295	0.291
Year	1996	0.89	0.87
Age	18.93	0.907	0.890
Years of completed education	9.11	1.01	0.98

	Mean	Std. Dev.	
		Overall	Within
Has an upper-secondary education degree	0.076	0.265	0.261
Incarceration conditions			
Duration (of the longest spell) in days	43.17	105.31	94.70
Closed prison	0.074	0.262	0
of which Copenhagen prison	0.060	0.240	0
Open prison	0.657	0.475	0
Local prison	0.269	0.443	0
Criminal behaviour before first incarceration (1 if at least one conviction in offence h)			
Violent and sexual offences	0.449	0.498	0.476
Robbery	0.074	0.261	0.248
Vandalism and arson	0.136	0.343	0.338
Theft, burglary and fencing	0.534	0.499	0.488
Drug-related offences	0.114	0.318	0.310
Weapons act	0.102	0.302	0.297
Threats	0.059	0.235	0.231
Other offences	0.476	0.499	0.484
Peer definition I: weighted share (in%) of peers with past convictions in			
Violent and sexual offences	11.761	3.408	2.429
Robbery	3.921	2.965	1.504
Vandalism and arson	5.588	1.674	1.443
Theft, burglary and fencing	20.148	3.268	2.177
Drug-related offences	9.590	3.597	1.780
Weapons act	4.642	1.755	1.254
Threats	3.011	1.339	1.122
Peer definition II: weighted share (in%) of peers under the age of 26 with past convictions in			
Violent and sexual offences	16.692	6.673	5.699
Robbery	5.126	5.115	3.327
Vandalism and arson	6.456	3.513	3.044
Theft, burglary and fencing	24.780	6.473	5.350
Drug-related offences	8.499	4.893	3.772
Weapons act	5.298	3.126	2.515
Threats	3.044	2.516	2.212
Individual characteristics of the municipality of residence in the year of incarceration (averages)			
Real gross income in DKK	206,027	17,836	16,790
Unemployment rate	9.286	2.680	2.47
Share of population of non-Western origin	4.257	3.588	3.13
Gini coefficient	0.263	0.023	0.02
Overall youth crime conviction rate	2.386	0.730	0.63
Crime detection rate	19.953	4.015	3.82
Reported crimes per capita	10.776	4.424	4.06

	Mean	Std. Dev.	
		Overall	Within
Reported violent crimes per 10,000 inhabitants	0.276	0.116	0.11
Number of police officers per 1,000 inhabitants	1.610	0.904	0.78
Labor market participation rate	0.774	0.030	0.029
Number of pupils per class	19.115	1.618	1.458
Peer characteristics at the time of incarceration			
Share of male inmates	0.959	0.098	0.021
Share of inmates below the age of 26	0.301	0.099	0.057
Share of inmates of non-Western origin	0.078	0.056	0.030
Share of inmates non-Danish residents	0.027	0.068	0.023
Share of inmates with an upper-secondary education degree	0.255	0.092	0.044
Share of inmates who are "hard criminals"	0.239	0.171	0.085
Share of inmates under 26 who are "hard criminals"	0.195	0.179	0.065
Share of hard criminals who are "clever" (1 or 2 incarcerations)	0.261	0.176	0.141
Share of young (under 26) hard criminals who are "clever" (1 or 2 incarcerations)	0.244	0.252	0.208
Share of hard criminals who are "stupid" (3 or more incarcerations)	0.739	0.176	0.141
Share of hard young (under 26) criminals who are "stupid" (3 or more incarcerations)	0.755	0.252	0.208
Unemployment rate in the peer's municipality of residence (weighted average)	9.591	1.599	1.262
Overall youth crime conviction rate in peer's municipality of residence (weighted average)	2.342	0.352	0.101
Other peer characteristics (not controlled for in the specifications)			
Average daily number of inmates in a facility	57		
Average daily number of inmates under the age of 26 in a facility	17		
Average daily number of inmates in a closed prison	69		
Average daily number of inmates under the age of 26 in a closed prison	30		
Average daily number of inmates in an open prison	124		
Average daily number of inmates under the age of 26 in an open prison	33		
Average daily number of inmates in a local prison	51		
Average daily number of inmates under the age of 26 in a local prison	18		
Past convictions with other offence categories for peers (Peer definition II: peers under the age of 26)			
Decency or children pornography	0.126	0.458	0.433
Falsification, fraud and tax evasion	4.786	3.497	2.745
Offences against the traffic act	17.350	7.756	4.127
Offences against the tax acts and other special acts	3.908	2.532	2.082
Other and unknown types of crime	3.934	3.005	2.528
Observations		1.928	

Notes: own calculations based on our sample of young inmates incarcerated for the first time between 1994 and 1997 at the age of 18 to 22. See the main text for more information on the data.

Table 2: Specialisation in crime

	Dep. var.: Indicator for recidivism within 12 months with						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prior offence	0.069**	0.012	0.035*	0.122**	0.112**	-0.011+	0.027
	(0.011)	(0.018)	(0.014)	(0.019)	(0.023)	(0.006)	(0.021)
No prior offence (aver. of off-diagonal coefficients)	0.024	-0.003	0.004	-0.021	0.020	0.004	0.005
Constant	0.026*	0.025*	0.020*	0.257**	0.043**	0.017*	0.012
	(0.012)	(0.011)	(0.008)	(0.046)	(0.015)	(0.006)	(0.007)
R-squared	0.019	0.002	0.012	0.070	0.037	0.004	0.005
Observations	1,928						

Notes: OLS estimations. The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Regressors are earlier convictions in the same offence as the one committed after release ("Prior offence") and criminal history in the other six types of offences (average of off-diagonal coefficients). Standard errors clustered at the facility-level are in parentheses. **: p<0.01, *: p<0.05, +:p<0.1.

Table 3: Predicted recidivism on the interacted weighted shares of peers convicted of offence type *h* (Peer definition I: all inmates; Peer definition II: inmates under the age of 26)

	Dependent variable: Indicator for predicted recidivism within 12 months with													
	Peer Definition I: all inmates							**Peer Definition II: inmates under age 26**						
	Violent and sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**	**Violent and sexual offences**	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
OffenceXpeers_h	0.004**	0.002**	0.003*	0.012**	0.013**	0.000	0.006**	0.002**	0.001*	0.003**	0.008**	0.011**	0.000	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No_offenceXpeers_h	-0.001+	0.001*	-0.002*	0.005**	0.002**	0.001	0.001	-0.001**	0.001*	-0.001*	0.002**	0.000	0.001	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
R-squared	0.069	0.008	0.022	0.156	0.148	0.003	0.007	0.060	0.007	0.018	0.161	0.121	0.002	0.003
Facility-by-prior-offence FE				NO							NO			
Observations				1,928							1,928			
OffenceXpeers_h	-0.001	-0.000	0.000	0.001	0.001	0.008*	-0.010+	-0.001	-0.000	-0.001	0.002+	-0.002	0.003	0.001
	(0.001)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
No_offenceXpeers_h	0.001	0.002**	-0.000	0.004*	0.002**	0.000	0.001	0.001	0.001*	-0.001	0.003**	-0.000	0.000	0.001*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
R-squared	0.379	0.304	0.314	0.531	0.441	0.218	0.351	0.379	0.302	0.315	0.533	0.439	0.217	0.352
Facility-by-prior-offence FE				YES							YES			
Observations				1,928							1,928			

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release predicted using individual and municipality characteristics in the year of incarceration and facility fixed effects. We exclude municipality characteristics that present high multicollinearity from the set of regressors. Predicted recidivism is then regressed on the interacted weighted share of peers convicted of offence type *h*, and facility-by-prior-offence fixed effects. Each column represents a different specification. For instance, offence *h* in the two interacted weighted shares of peers convicted of offence type *h* in columns (1) and (8) is violent and sexual offences. Specifications (1) to (7) and specifications (8) to (14), respectively, are simultaneously estimated as a SUR. Standard errors in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table 4: Crime-specific peer effects on recidivism (Peer definition I: all inmates; Peer Definition II: inmates under the age of 26; and comparing Peer definitions I and II in the same specification)

	Dep. variable: indicator for recidivism within 12 months with:						
Peer definition	**Violent and Sexual offences**	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A - *Peer definition I: all inmates*							
Offence X all peers_h (β_0)	-0.006	-0.020*	-0.003	-0.007	0.043**	0.004	0.053**
	(0.004)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.016)
No_offence X all peers_h (β_1)	0.005	0.002	-0.003	0.004	-0.003	-0.006+	0.005
	(0.005)	(0.003)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)
R-squared	0.355	0.293	0.405	0.426	0.368	0.357	0.317
Panel B - *Peer definition II***:** *inmates under age 26*							
Offence X young peers_h (β_0)	-0.001	-0.010*	-0.002	0.001	0.031**	0.004	0.018*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)
No_offence X young peers_h (β_1)	-0.000	0.000	-0.003+	0.001	-0.001	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
R-squared	0.353	0.294	0.406	0.424	0.377	0.356	0.314
Panel C - *Peer definitions i and II*							
Offence X all peers_h (β_0)	-0.009	-0.012	-0.000	-0.017+	0.020+	0.001	0.044*
	(0.006)	(0.017)	(0.011)	(0.009)	(0.012)	(0.013)	(0.019)
No_offence X all peers_h (β_1)	0.006	0.003	0.001	0.001	-0.002	-0.006+	0.007+
	(0.005)	(0.004)	(0.004)	(0.009)	(0.005)	(0.004)	(0.004)
Offence X young peers_h (β_2)	0.002	-0.006	-0.004	0.006	0.026**	0.002	0.007
	(0.003)	(0.009)	(0.005)	(0.004)	(0.006)	(0.006)	(0.009)
No_offence X young peers_h (β_3)	-0.001	-0.001	-0.004+	0.001	-0.001	-0.000	-0.002
	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)
R-squared	0.357	0.300	0.410	0.430	0.381	0.361	0.320
Observations	1,928						

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Each column represents a different specification. For instance, offence *h* in the two interacted weighted shares of peers (first two rows) is "violent and sexual offences" in column (1). Covariates include individual criminal history and socioeconomic variables. individual's municipality characteristics (at the time of incarceration) and municipality dummies, weighted shares of peers convicted of each of the off-diagonal offences, controls for weighted share of inmates in particular demographic groups: under the age of 26, of non-Western origin, non-Danish residents, male, who have completed an upper-secondary education degree, and controls for peers' municipality characteristics such as average unemployment rate and average youth crime conviction rate. See the Appendix for the estimates of all control variables included. Specifications in each panel are simultaneously estimated as a SUR. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table 5: Crime-specific peer effects on recidivism: network sorting

Peer definition	Dep. variable: indicator for recidivism within 12 months with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A - *Peer definition I: all inmates*							
Offence X all peers (β_0)	-0.006	-0.020*	-0.003	-0.007	0.043**	0.004	0.053**
	(0.004)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.016)
R-squared	0.355	0.293	0.405	0.426	0.368	0.357	0.317
Panel B - *Peer definition***:** *inmates from the same ethnic group (Western/non-Western)*							
Offence X own ethnic group peers_h (β_0)	0.000	-0.006	-0.002	-0.004	0.042**	0.002	-0.006
	(0.002)	(0.005)	(0.007)	(0.004)	(0.008)	(0.006)	(0.007)
R-squared	0.353	0.292	0.407	0.426	0.373	0.363	0.314
Panel C - *Peer definition***:** *inmates from the same county of residence*							
Offence X own county peers_h (β_0)	0.000	0.000	0.006	-0.003*	0.001	-0.000	0.006
	(0.001)	(0.003)	(0.004)	(0.001)	(0.003)	(0.004)	(0.007)
R-squared	0.352	0.293	0.403	0.427	0.363	0.353	0.315
Panel D - *Peer definition II: young inmates (under age 26)*							
Offence X young peers_h (β_0)	-0.001	-0.010*	-0.002	0.001	0.031**	0.004	0.018*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)
R-squared	0.353	0.294	0.406	0.424	0.377	0.356	0.314
Panel E - *Peer definition***:** young *inmates from the same ethnic group (Western/non-Western)*							
Offence X young own ethnic group peers_h (β_0)	0.000	-0.005	-0.004	0.000	0.027**	0.003	-0.001
	(0.001)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)
R-squared	0.357	0.293	0.406	0.428	0.381	0.362	0.312
Panel F - *Peer definition***:** young *inmates from the same county of residence*							
Offence X young own county peers_h (β_0)	-0.000	-0.001	0.002	-0.001	-0.004	0.000	-0.002
	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.004)
R-squared	0.352	0.294	0.404	0.426	0.362	0.354	0.313
Panel G - *all peers vs. peers from the same ethnic origin*							
Offence X all peers_h (β_0)	-0.008	-0.021+	0.000	-0.006	0.003	-0.004	0.065**
	(0.005)	(0.012)	(0.012)	(0.010)	(0.016)	(0.013)	(0.017)
Offence X own ethnic group peers_h (β_2)	0.002	0.001	-0.003	-0.002	0.041**	0.003	-0.015+
	(0.003)	(0.006)	(0.009)	(0.006)	(0.012)	(0.009)	(0.008)
R-squared	0.364	0.295	0.413	0.432	0.378	0.368	0.321
Panel H - *young peers vs. young peers from the same ethnic origin*							
Offence X young peers_h (β_0)	-0.001	-0.008	0.004	0.001	0.018*	0.002	0.023**
	(0.003)	(0.007)	(0.007)	(0.004)	(0.008)	(0.007)	(0.009)
Offence X young own ethnic	0.000	-0.002	-0.007	-0.001	0.015*	0.001	-0.005

group peers_h (β_0)							
	(0.001)	(0.004)	(0.006)	(0.003)	(0.007)	(0.006)	(0.004)
R-squared	0.358	0.297	0.410	0.429	0.386	0.368	0.316
Observations	1,928						

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Offence *h* in column (1) is "violent and sexual offences"; in column (2) "robbery", and so forth. Each panel uses a different peer definition. For simplicity, we only show results for reinforcing peer effects in this table. Coefficients in Panels A to F are estimated using Eq. (3) and Panels G and H are estimated using Eq. (4). All estimations include controls for individual socioeconomic and criminal history characteristics, municipality characteristics and dummies, and peer characteristics. Specifications in each panel are simultaneously estimated as a SUR and include facility fixed effects, time fixed effects and facility-by-prior-offense fixed effects. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table 6: Crime-specific peer effects on recidivism: educated and uneducated peers

Peer definition	Dep. variable: indicator for recidivism within 12 months with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A - *Peer definition: inmates who did not complete an upper-secondary education*							
Offence X uneducated peers_h (β_0)	-0.005	-0.005	-0.012	-0.013*	0.039**	-0.000	0.035**
	(0.005)	(0.008)	(0.008)	(0.006)	(0.010)	(0.008)	(0.012)
R-squared	0.354	0.292	0.405	0.427	0.370	0.357	0.318
Panel B - *Peer definition: inmates who completed an upper-secondary education*							
Offence X educated peers_h (β_0)	-0.005**	-0.022**	0.003	0.002	0.010**	0.004	0.009
	(0.002)	(0.005)	(0.004)	(0.002)	(0.004)	(0.005)	(0.010)
R-squared	0.357	0.299	0.403	0.423	0.364	0.356	0.320
Panel C - *Peer definition:* young *inmates who did not complete an upper-secondary education*							
Offence X young uneducated peers_h (β_0)	0.001	-0.007	-0.000	-0.003	0.028**	0.003	0.016*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.007)
R-squared	0.353	0.293	0.406	0.425	0.376	0.356	0.315
Panel D - *Peer definition:* young *inmates who completed an upper-secondary education*							
Offence X young educated peers_h (β_0)	-0.001	-0.012**	-0.001	0.003**	0.002	0.001	-0.000
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
R-squared	0.356	0.305	0.406	0.429	0.364	0.361	0.312
Panel E: *all peers vs. peers with no upper-secondary education*							
Offence X all peers_h (β_0)	-0.010	-0.145**	0.026+	0.015	0.029	0.010	0.044
	(0.007)	(0.031)	(0.016)	(0.014)	(0.024)	(0.020)	(0.035)
Offence X uneducated peers_h (β_2)	0.005	0.114**	-0.031*	-0.023*	0.014	-0.007	0.007
	(0.008)	(0.027)	(0.014)	(0.011)	(0.023)	(0.016)	(0.026)
R-squared	0.359	0.304	0.409	0.428	0.375	0.359	0.321
Panel F: *all peers vs. peers who completed an upper-secondary education*							
Offence X all peers_h (β_0)	-0.001	-0.016+	-0.007	-0.014+	0.039**	0.003	0.051**
	(0.005)	(0.010)	(0.011)	(0.008)	(0.012)	(0.010)	(0.017)
Offence X educated peers_h (β_2)	-0.005*	-0.021**	0.004	0.003	0.004	0.004	-0.001
	(0.002)	(0.006)	(0.005)	(0.002)	(0.005)	(0.005)	(0.011)
R-squared	0.360	0.304	0.406	0.428	0.374	0.361	0.326
Panel G: *young peers vs. young peers who did not complete an upper-secondary education*							
Offence X young peers_h (β_0)	-0.004	-0.049*	-0.009	0.016*	0.030*	0.003	0.010
	(0.005)	(0.023)	(0.009)	(0.006)	(0.014)	(0.010)	(0.013)
Offence X young uneducated peers_h (β_2)	0.003	0.036+	0.007	-0.014**	0.001	0.001	0.009
	(0.005)	(0.020)	(0.008)	(0.005)	(0.014)	(0.009)	(0.012)
R-squared	0.357	0.296	0.408	0.430	0.379	0.359	0.316

Panel H: *young peers vs. young peers who completed an upper-secondary education*

Offence X young peers_h (β_0)	0.000	-0.003	-0.002	-0.002	0.032**	0.003	0.021*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.005)	(0.009)
Offence X young educated peers_h (β_2)	-0.001	-0.011**	-0.001	0.003**	-0.002	0.000	-0.003
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
R-squared	0.359	0.309	0.410	0.432	0.384	0.366	0.318
Observations	1,928						

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Offence *h* in column (1) is "violent and sexual offences"; in column (2) "robbery", and so forth. Each panel uses a different peer definition. For simplicity, we only show results for reinforcing peer effects in this table. Coefficients in Panels A to D are estimated using Eq. (3) and Panels E to H are estimated using Eq. (4). All estimations include controls for individual socioeconomic and criminal history characteristics, municipality characteristics and dummies, and peer characteristics. Specifications in each panel are simultaneously estimated as a SUR and include facility fixed effects, time fixed effects and facility-by-prior-offense fixed effects. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table 7: Crime-specific peer effects on recidivism: stupid and clever hard criminals

Peer definition	Dep. variable: indicator for recidivism within 12 months with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A - *Peer definition: inmates who served a total of more than 180 days behind bars ("hard criminals")*							
Offence X hard criminals peers_h (β_0)	-0.003	0.005	0.013**	-0.002	-0.004	0.001	0.008*
	(0.003)	(0.007)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)
R-squared	0.353	0.291	0.408	0.424	0.363	0.361	0.313
Panel B - *Peer definition: "STUPID" hard criminals who already spent a total of six months over three or more sentences*							
Offence X stupid hard criminals peers_h (β_0)	0.002	0.007	0.006+	0.000	-0.001	0.001	0.005+
	(0.002)	(0.005)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
R-squared	0.354	0.293	0.406	0.426	0.363	0.368	0.314
Panel C - *Peer definition: "CLEVER" hard criminals who already spent a total of six months over less than three sentences*							
Offence X clever hard criminals peers_h (β_0)	-0.001	-0.003	0.002	-0.001	-0.002+	-0.000	0.002
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)
R-squared	0.354	0.294	0.414	0.426	0.364	0.355	0.314
Panel D - *Peer definition:* young *inmates who served a total of more than 180 days behind bars ("young hard criminals")*							
Offence X young hard criminals peers_h (β_0)	-0.000	-0.006	0.011	0.002	0.022**	0.006	-0.956
	(0.002)	(0.005)	(0.007)	(0.001)	(0.005)	(0.013)	(2.348)
R-squared	0.352	0.299	0.407	0.427	0.368	0.366	0.312
Panel E - *Peer definition:* young *"STUPID" hard criminals who already spent a total of six months over three or more sentences*							
Offence X young stupid hard criminals peers_h (β_0)	0.002	0.001	0.007**	-0.001	0.003*	0.002	0.000
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
R-squared	0.357	0.292	0.407	0.426	0.364	0.356	0.314
Panel F - *Peer definition:* young *"CLEVER" hard criminals who already spent a total of six months over less than three sentences*							
Offence X young clever hard criminals peers_h (β_0)	0.000	0.000	-0.001	-0.001	0.003*	0.000	0.006
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)
R-squared	0.354	0.296	0.403	0.424	0.364	0.355	0.314
Panel G: *all peers vs. "hard criminal" peers*							
Offence X all peers_h (β_0)	-0.005	-0.027*	-0.015	-0.009	0.049**	0.005	0.048*
	(0.004)	(0.011)	(0.010)	(0.008)	(0.011)	(0.010)	(0.019)
Offence X hard criminals peers_h (β_2)	-0.002	0.012+	0.016**	-0.001	-0.007*	0.001	0.003
	(0.003)	(0.007)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)
R-squared	0.358	0.298	0.412	0.428	0.374	0.365	0.319
Panel H: *all peers vs. "stupid hard criminal" peers*							
Offence X all peers_h (β_0)	-0.007	-0.023*	-0.007	-0.008	0.044**	0.006	0.046*
	(0.004)	(0.010)	(0.010)	(0.008)	(0.010)	(0.010)	(0.018)

Offence X stupid hard criminals peers_h (β_2)	0.002	0.008+	0.006*	0.001	-0.002	0.001	0.002
	(0.002)	(0.005)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
R-squared	0.361	0.299	0.409	0.430	0.373	0.372	0.319
Panel I: *young peers vs. young "hard criminal" peers*							
Offence X young peers_h (β_0)	-0.001	-0.010+	-0.003	-0.001	0.026**	0.004	0.018*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)
Offence X young hard criminals peers_h (β_2)	-0.001	-0.005	0.013+	0.002	0.015**	0.005	-1.335
	(0.002)	(0.005)	(0.007)	(0.001)	(0.005)	(0.013)	(2.349)
R-squared	0.355	0.303	0.411	0.430	0.383	0.371	0.316
Panel J: *young peers vs. young "stupid hard criminal" peers*							
Offence X young peers_h (β_0)	-0.002	-0.011*	-0.005	0.002	0.029**	0.003	0.019*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)
Offence X young stupid hard criminals peers_h (β_2)	0.001	0.001	0.007**	-0.001	0.001	0.002	-0.002
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
R-squared	0.361	0.298	0.412	0.429	0.380	0.361	0.318

Notes: The dependent variable is an indicator for whether an individual is convicted of offence h within 12 months after release. Offence h in column (1) is "violent and sexual offences"; in column (2) "robbery", and so forth. Each panel uses a different peer definition. For simplicity, we only show results for reinforcing peer effects in this table. Coefficients in Panels A to F are estimated using Eq. (3) and Panels G to J are estimated using Eq. (4). All estimations include controls for individual socioeconomic and criminal history characteristics, municipality characteristics and dummies, and peer characteristics. Specifications in each panel are simultaneously estimated as a SUR and include facility fixed effects, time fixed effects and facility-by-prior-offense fixed effects. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table 8: Crime-specific peer effects on recidivism within 12, 24 and 36 months

Peer definition	Dep. variable: indicator for recidivism with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats	Dep. variable: number of convictions after release with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Panel A: *Recidivism within 12 months*														
Offence X all peers_h (β_0)	-0.006	-0.020*	-0.003	-0.007	0.043**	0.004	0.053**	-0.011*	-0.020*	-0.003	-0.014	0.051**	0.002	0.055**
	(0.004)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.016)	(0.005)	(0.010)	(0.010)	(0.013)	(0.012)	(0.011)	(0.017)
R-squared	0.355	0.293	0.405	0.426	0.368	0.357	0.317	0.343	0.293	0.399	0.422	0.403	0.333	0.304
Offence X hard criminals peers_h (β_0)	-0.003	0.005	0.013**	-0.002	-0.004	0.001	0.008*	-0.002	0.005	0.013**	0.000	-0.003	0.001	0.008*
	(0.003)	(0.007)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.007)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
R-squared	0.353	0.291	0.408	0.424	0.363	0.361	0.313	0.339	0.291	0.403	0.422	0.401	0.337	0.300
Offence X young peers_h (β_0)	-0.001	-0.010*	-0.002	0.001	0.031**	0.004	0.018*	-0.002	-0.010+	-0.002	-0.006	0.027**	0.003	0.017*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)	(0.003)	(0.005)	(0.004)	(0.006)	(0.006)	(0.005)	(0.008)
R-squared	0.353	0.294	0.406	0.424	0.377	0.356	0.314	0.340	0.294	0.401	0.423	0.407	0.330	0.302
Offence X young hard criminal peers_h (β_0)	-0.000	-0.005	0.011	0.002	0.022**	0.005	-0.944	0.001	-0.005	0.011	0.006*	0.022**	0.011	-1.189
	(0.002)	(0.005)	(0.007)	(0.001)	(0.005)	(0.013)	(2.348)	(0.003)	(0.005)	(0.007)	(0.002)	(0.006)	(0.014)	(2.453)
R-squared	0.352	0.298	0.407	0.427	0.366	0.365	0.312	0.339	0.298	0.401	0.421	0.402	0.348	0.299
Offence X uneducated peers_h (β_0)	-0.005	-0.005	-0.012	-0.013*	0.039**	-0.000	0.035**	-0.010+	-0.005	-0.013	-0.016	0.048**	-0.002	0.036**
	(0.005)	(0.008)	(0.008)	(0.006)	(0.010)	(0.008)	(0.012)	(0.006)	(0.008)	(0.009)	(0.010)	(0.011)	(0.009)	(0.013)
R-squared	0.354	0.292	0.405	0.427	0.370	0.357	0.318	0.341	0.292	0.400	0.424	0.406	0.332	0.305
Offence X educated peers_h (β_0)	-0.005**	-0.022**	0.003	0.002	0.010**	0.004	0.009	-0.007**	-0.022**	0.003	-0.001	0.009+	0.004	0.008
	(0.002)	(0.005)	(0.004)	(0.002)	(0.004)	(0.005)	(0.010)	(0.002)	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)	(0.011)
R-squared	0.357	0.299	0.403	0.423	0.364	0.356	0.320	0.344	0.299	0.397	0.421	0.398	0.332	0.306
Offence X young uneducated peers_h (β_0)	0.001	-0.007	-0.000	-0.003	0.028**	0.003	0.016*	0.000	-0.007	-0.001	-0.012*	0.024**	0.002	0.016*

Peer definition	Dep. variable: indicator for recidivism with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats	Dep. variable: number of convictions after release with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.007)	(0.002)	(0.005)	(0.004)	(0.005)	(0.006)	(0.004)	(0.008)
R-squared	0.353	0.293	0.406	0.425	0.376	0.356	0.315	0.339	0.293	0.400	0.424	0.406	0.330	0.302
Offence X young educ. peers_h (β_0)	-0.001	-0.012**	-0.001	0.003**	0.002	0.001	-0.000	-0.001	-0.012**	-0.001	0.002	0.004+	0.001	0.000
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
R-squared	0.356	0.305	0.406	0.429	0.364	0.361	0.312	0.342	0.305	0.400	0.420	0.401	0.336	0.299
Panel B: *Recidivism within 24 months*														
Offence X all peers_h (β_0)	-0.014*	-0.033*	0.005	-0.006	0.060**	0.010	0.049*	-0.020**	-0.033*	0.004	-0.005	0.106**	0.009	0.052*
	(0.006)	(0.013)	(0.013)	(0.008)	(0.013)	(0.014)	(0.023)	(0.007)	(0.014)	(0.014)	(0.020)	(0.018)	(0.015)	(0.026)
R-squared	0.329	0.292	0.385	0.453	0.374	0.335	0.338	0.329	0.290	0.379	0.433	0.388	0.342	0.349
Offence X hard criminals peers_h (β_0)	-0.008*	0.009	0.016**	-0.002	-0.005	-0.007	0.011*	-0.012**	0.010	0.015**	-0.006	-0.009+	-0.007	0.011+
	(0.003)	(0.009)	(0.005)	(0.002)	(0.004)	(0.005)	(0.005)	(0.004)	(0.009)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
R-squared	0.327	0.290	0.390	0.453	0.365	0.336	0.335	0.328	0.288	0.384	0.433	0.377	0.343	0.345
Offence X young peers_h (β_0)	-0.004	-0.011	-0.007	-0.005	0.028**	-0.009	0.018	-0.005	-0.011	-0.007	-0.004	0.055**	-0.010	0.017
	(0.003)	(0.007)	(0.006)	(0.003)	(0.006)	(0.006)	(0.011)	(0.004)	(0.007)	(0.006)	(0.009)	(0.009)	(0.007)	(0.012)
R-squared	0.325	0.291	0.383	0.452	0.376	0.333	0.335	0.327	0.289	0.378	0.433	0.393	0.339	0.346
Offence X young hard criminal peers_h (β_0)	-0.003	-0.010	0.018+	0.002	0.018**	-0.004	-2.337	-0.002	-0.009	0.018+	0.006+	0.020*	-0.000	-3.133
	(0.003)	(0.007)	(0.010)	(0.001)	(0.006)	(0.019)	(3.309)	(0.004)	(0.007)	(0.010)	(0.003)	(0.009)	(0.021)	(3.635)
R-squared	0.324	0.290	0.392	0.453	0.367	0.336	0.336	0.325	0.287	0.386	0.432	0.377	0.346	0.350
Offence X uneducated peers_h (β_0)	-0.013+	-0.021+	-0.020+	-0.010	0.050**	0.014	0.042*	-0.022**	-0.021+	-0.021+	-0.020	0.100**	0.012	0.044*
	(0.007)	(0.011)	(0.011)	(0.006)	(0.012)	(0.011)	(0.017)	(0.008)	(0.012)	(0.013)	(0.016)	(0.017)	(0.013)	(0.019)
R-squared	0.329	0.291	0.385	0.453	0.374	0.335	0.337	0.330	0.290	0.380	0.434	0.389	0.340	0.348

Peer definition	Dep. variable: indicator for recidivism with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats	Dep. variable: number of convictions after release with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Offence X educated peers_h (β_0)	-0.007**	0.005	0.011+	0.003	0.010*	-0.011	-0.015	-0.011**	0.006	0.013+	-0.004	-0.005	-0.011	-0.015
	(0.002)	(0.008)	(0.006)	(0.002)	(0.005)	(0.007)	(0.015)	(0.003)	(0.008)	(0.007)	(0.006)	(0.007)	(0.008)	(0.016)
R-squared	0.327	0.291	0.384	0.447	0.366	0.334	0.337	0.330	0.290	0.379	0.433	0.375	0.340	0.346
Offence X young uneducated peers_h (β_0)	-0.000	-0.007	-0.007	-0.004	0.023**	-0.009	0.018+	-0.001	-0.007	-0.007	-0.010	0.047**	-0.010	0.018
	(0.003)	(0.006)	(0.006)	(0.003)	(0.006)	(0.006)	(0.010)	(0.004)	(0.006)	(0.006)	(0.007)	(0.008)	(0.006)	(0.011)
R-squared	0.325	0.291	0.383	0.453	0.373	0.337	0.336	0.326	0.289	0.378	0.433	0.390	0.341	0.346
Offence X young educ. peers_h (β_0)	-0.003*	-0.010**	-0.010**	0.002+	0.004	-0.005+	-0.001	-0.003*	-0.010*	-0.002	0.002	0.006+	-0.004	-0.001
	(0.001)	(0.004)	(0.004)	(0.001)	(0.003)	(0.003)	(0.003)	(0.001)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
R-squared	0.329	0.293	0.388	0.451	0.363	0.341	0.333	0.329	0.290	0.383	0.431	0.375	0.346	0.343
Panel C: *Recidivism within 36 months*														
Offence X all peers_h (β_0)	-0.013*	-0.052**	0.003	-0.011	0.046**	0.020	0.038	-0.022*	-0.053**	0.003	-0.017	0.117**	0.017	0.043
	(0.006)	(0.015)	(0.015)	(0.008)	(0.015)	(0.016)	(0.026)	(0.009)	(0.017)	(0.016)	(0.024)	(0.023)	(0.018)	(0.030)
R-squared	0.370	0.300	0.383	0.438	0.390	0.357	0.343	0.333	0.304	0.388	0.444	0.382	0.364	0.357
Offence X hard criminals peers_h (β_0)	-0.008*	-0.019+	0.018**	-0.003	-0.003	-0.005	0.006	-0.013*	-0.018	0.017**	-0.012+	-0.005	-0.006	0.007
	(0.004)	(0.010)	(0.006)	(0.002)	(0.004)	(0.005)	(0.006)	(0.005)	(0.011)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
R-squared	0.366	0.297	0.388	0.438	0.387	0.356	0.341	0.331	0.302	0.393	0.444	0.375	0.363	0.353
Offence X young peers_h (β_0)	-0.003	-0.012	-0.007	-0.005	0.025**	-0.007	0.015	-0.005	-0.014	-0.007	0.001	0.067**	-0.009	0.019
	(0.003)	(0.008)	(0.006)	(0.004)	(0.007)	(0.007)	(0.013)	(0.005)	(0.009)	(0.007)	(0.011)	(0.011)	(0.008)	(0.014)
R-squared	0.363	0.296	0.384	0.438	0.392	0.354	0.339	0.328	0.299	0.389	0.444	0.386	0.360	0.352
Offence X young hard criminal peers_h (β_0)	-0.004	-0.009	0.012	0.001	0.011	0.001	-3.477	-0.004	-0.011	0.013	0.007+	0.013	0.002	-4.459

Peer definition	Dep. variable: indicator for recidivism with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats	Dep. variable: number of convictions after release with: Violent and Sexual offences	Robbery	Vandalism and arson	Theft, burglary and fencing	Drugs	Weapons	Threats
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	(0.003)	(0.008)	(0.011)	(0.001)	(0.007)	(0.021)	(3.753)	(0.005)	(0.009)	(0.012)	(0.004)	(0.011)	(0.025)	(4.258)
R-squared	0.363	0.295	0.389	0.435	0.392	0.356	0.348	0.327	0.298	0.393	0.442	0.377	0.366	0.364
Offence X uneducated peers_h (β_0)	-0.015*	-0.034**	-0.028*	-0.015*	0.037**	0.012	0.038+	-0.027**	-0.035*	-0.028*	-0.029	0.096**	0.014	0.044*
	(0.007)	(0.013)	(0.013)	(0.007)	(0.014)	(0.013)	(0.020)	(0.010)	(0.014)	(0.014)	(0.020)	(0.022)	(0.015)	(0.022)
R-squared	0.370	0.298	0.385	0.436	0.391	0.357	0.343	0.334	0.302	0.389	0.444	0.382	0.363	0.356
Offence X educated peers_h (β_0)	-0.007**	0.001	0.016*	0.003	0.011+	0.003	-0.012	-0.011**	0.002	0.017*	-0.008	0.004	0.002	-0.018
	(0.002)	(0.009)	(0.007)	(0.002)	(0.006)	(0.008)	(0.017)	(0.003)	(0.009)	(0.007)	(0.007)	(0.009)	(0.010)	(0.019)
R-squared	0.364	0.297	0.384	0.433	0.390	0.354	0.344	0.329	0.301	0.389	0.446	0.375	0.362	0.356
Offence X young uneducated peers_h (β_0)	-0.001	-0.006	-0.006	-0.004	0.021**	-0.012+	0.018	-0.002	-0.008	-0.006	-0.009	0.060**	-0.015+	0.022
	(0.003)	(0.007)	(0.006)	(0.003)	(0.007)	(0.006)	(0.012)	(0.004)	(0.008)	(0.007)	(0.008)	(0.011)	(0.008)	(0.013)
R-squared	0.363	0.295	0.384	0.439	0.390	0.358	0.340	0.329	0.299	0.389	0.445	0.384	0.363	0.353
Offence X young educ. peers_h (β_0)	-0.001	-0.008+	-0.003	0.002+	0.002	0.003	-0.001	-0.002	-0.009+	-0.003	0.001	0.004	0.002	-0.001
	(0.001)	(0.004)	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.005)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
R-squared	0.365	0.298	0.388	0.436	0.388	0.361	0.340	0.330	0.302	0.392	0.442	0.374	0.368	0.352
Observations	1,928							1,928						

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* (Set I) or the number of new convictions of offence *h* (Set II) within 12 months (Panel A), 24 months (Panel B) or 36 months (Panel C) after release. Each column represents a different specification. For instance, offence *h* in the interacted weighted shares of peers is "violent and sexual offences" in column (1). Specifications include controls for individual characteristics, municipality characteristics and dummies, peer characteristics, facility fixed effects, time fixed effects, and facility-by-prior-offense fixed effects. For simplicity, we only show results for reinforcing peer effects (β_0) in this table. Specifications in each panel are simultaneously estimated as a SUR. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Appendix

Table A1: Variable definitions and primary data sources

Variable	Definition	Primary data source
Individual characteristics		
Recidivism rate overall	Dummy for having been convicted (i.e. found guilty) of any offence within one year after release	Central Police Register, Statistics Denmark (DST)
Recidivism rate; criminal offence of type j	Dummy for having been convicted i.e. found guilty) of an offence of type j (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) within one year (baseline) after release	Central Police Register, DST
Criminal history in crime category j prior to first incarceration	Dummy for having been convicted (i.e. found guilty) of at least one offence of type j (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) prior to the first incarceration	Central Police Register, DST
Male	Dummy for male	Population register, DST
Upper-secondary degree	Dummy for having completed an upper-secondary education degree at the time of incarceration	Educational Institution Register and Surveys, DST
Ethnic Dane	Dummy for being born in Denmark of Danish parents. The dummy equals 0 for first-generation and second-generation immigrants.	Population register, DST
Married	Dummy for being married at the time of incarceration	Population register, DST
Has at least one child under 6	Dummy for having at least one child under the age of six at the time of incarceration	Population register, DST
Age	Age at the time of incarceration	Population register, DST
Duration in days	Duration in days of the time spent during the first incarceration (in the longest spell in case the individual transfers across facilities)	Central Police Register, DST
Closed prison	Dummy for spending the longest spell in a closed prison	Central Police Register, DST
Of which Copenhagen prison	Dummy for spending the longest spell in one of the closed prisons in Copenhagen	Central Police Register, DST
Open prison	Dummy for spending the longest spell in an open prison	Central Police Register, DST
Local prison	Dummy for spending the longest spell in a local prison	Central Police Register, DST
Peer characteristics		
Share (in %) of peer under the age of 26 with a criminal history in crime category *j*	Weighted average of the share of other inmates under the age of 26 with at least one conviction of type *j* (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) at the individual's time of incarceration	Central Police Register, DST
Share (in %) of peer of the same ethnic origin with a criminal history in crime category *j*	Weighted average of the share of other inmates of the same ethnic origin (Western including Danish vs. non-Western) with at least one conviction of type *j* (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) at the individual's time of incarceration	Central Police Register, DST

Variable	Definition	Primary data source
Share (in %) of peer of the same ethnic origin and below age 26 with a criminal history in crime category *j*	Weighted average of the share of other inmates of the same ethnic origin (Western including Danish vs. non-Western) and below age 26 with at least one conviction of type *j* (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) at the individual's time of incarceration	Central Police Register, DST
Share (in %) of peer residing in the same county and below age 26 with a criminal history in crime category *j*	Weighted average of the share of other inmates residing in the same county and under the age of 26 at the individual's time of incarceration with at least one conviction of type *j* (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) at the individual's time of incarceration	Central Police Register, DST
Share (in %) of peer - general definition - with a criminal history in crime category *j*	Weighted average of the share of other inmates with at least one conviction of type *j* (j=misdemeanour assault, burglary, theft, stolen goods handling, drug-related offences, other offences) at the individual's time of incarceration	Central Police Register, DST
Share of inmates below the age of 26	Share of other inmates (foreigners excluded) below age 26 in the individual's year of incarceration	Central Police Register, Population Register, DST
Share of male inmates	Share of inmates (foreigners excluded) who are male	Central Police Register, Population Register, DST
Share of inmates of non-Western origin	Share of other inmates (foreigners excluded) who are immigrants (first or second generation) from a non-Western country	Central Police Register, Population Register, DST
Share of inmates non-Danish residents	Share of other inmates who are foreigners, i.e. do not have registered residence in Denmark, in the individual's year of incarceration	Central Police Register, DST
Share of inmates with a vocational education degree	Share of other inmates (foreigners excluded) who have completed a vocational (professional) education degree in the individual's year of incarceration	Central Police Register, Educational Institution Register and Surveys, DST
Unemployment rate in the peer's municipality of residence	Weighted average of the unemployment rate (in %) in the municipality of residence of peers in the year of incarceration of peers	Central Police Register, Population Register, DST
Overall crime rate in the peer's municipality of residence	Weighted average of the share (in %) of individuals aged 15 to 25 who have been convicted of an offence (except traffic offences) committed in the municipality of residence of peers in the year of the incarceration of peers	"Statistiske Efterretninger om Social Sikring og Retsvæsen", DST (1986-1998)
Municipality Characteristics		
Real gross income in DKK	Average real gross income in DKK in the municipality in the individual's year of incarceration (in 2000-prices)	Authors' construction from time series IF221 and BEF1A in Statistikbanken, DST.
Unemployment rate	The unemployment rate (in %) in the municipality in the individual's year of incarceration	Authors' construction from time series AARD in Statistikbanken, DST.
Share of population of non-Western origin	Share of the municipal population of non-Western origin in the individual's year of incarceration	Authors calculations from population register, DST.
Gini coefficient	Gini coefficient of household incomes in the municipality in the individual's year of incarceration	Authors' calculations from tax register, DST.
Youth crime conviction rate	Share (in %) of individuals aged 15 to 25 living in the municipality who have been convicted of an offence (except traffic offences) committed in the individual's year of incarceration	Central Police Register, DST

Variable	Definition	Primary data source
Crime detection rate	Annual number of charges divided by the annual number of reported crimes in the municipality (or police district) in the individual's year of incarceration	"Statistiske Efterretninger om Social Sikring og Retsvæsen", DST (1986-1998)
Reported crimes per capita	Number of reported crimes divided by the number of inhabitants in the municipality (or police district) in the year of the individual's incarceration	"Statistiske Efterretninger om Social Sikring og Retsvæsen", DST (1986-1998)
Reported violent crimes per 10,000 inhabitants	Number of reported violent crimes divided by the number of inhabitants in the municipality (or police district) and multiplied by 10,000 in the individual's year of the incarceration	"Statistiske Efterretninger om Social Sikring og Retsvæsen", DST (1986-1998)
Number of police agents per 1,000 inhabitants	Sum of number of detectives and uniformed police officers employed in the police district per 1,000 inhabitants.	Annual reports from the Police (1986-1999)
Labour market participation rate	Share of the population in the municipality who is active on the labour market in the year of the individual's incarceration	Authors' construction from time series RAS1 and BEF1A in Statistikbanken, DST.
Number of pupils per class	Average number of pupils per class (only normal classes) in the municipality in the individual's year of the incarceration	"Folkeskolen i de enkelte kommuner", Ministry of Education (1989-1993)

Table A2: Summary statistics: alternative peer definitions

	Mean	Std. Dev.	
		Overall	Within
ETHNIC ORIGIN (YOUNG): *Weighted share (in%) of peers under age 26 from the same ethnic origin with past convictions in*			
Violent and sexual offences	17.150	9.695	8.881
Robbery	5.150	6.253	4.821
Vandalism and arson	6.305	4.133	3.778
Theft, burglary and fencing	24.538	8.184	7.319
Drug-related offences	8.340	5.990	5.148
Weapons act	5.306	5.167	4.763
Threats	3.070	3.454	3.237
ETHNIC ORIGIN (ALL): *Weighted share (in%) of peers from the same ethnic origin with past convictions in*			
Violent and sexual offences	12,230	5,215	4,418
Robbery	4,053	3,574	2,330
Vandalism and arson	5,555	2,408	2,262
Theft, burglary and fencing	20,363	4,362	3,449
Drug-related offences	9,691	4,320	2,813
Weapons act	4,713	2,418	2,002
Threats	3,182	2,602	2,447
COUNTY (YOUNG): *Weighted share (in%) of peers under age 26 from the same county with past convictions in*			
Violent and sexual offences	16.582	14.442	13.584
Robbery	4.924	9.523	8.442
Vandalism and arson	5.849	6.623	6.376
Theft, burglary and fencing	23.868	14.945	14.303
Drug-related offences	7.416	8.473	7.910
Weapons act	4.520	5.438	5.162
Threats	2.612	5.586	5.479
COUNTY (ALL): *Weighted share (in%) of peers from the same county with past convictions in*			
Violent and sexual offences	12,004	8,763	8,029
Robbery	4,053	7,328	6,524
Vandalism and arson	5,346	3,489	3,348
Theft, burglary and fencing	19,897	9,295	8,709
Drug-related offences	9,032	6,744	5,872
Weapons act	4,301	3,405	3,152
Threats	2,939	3,360	3,256
HARD CRIMINALS (YOUNG): *Weighted share (in%) of peers under age 26 who have served at least 180 days of their lives behind bars ("young hard criminals") with past convictions in*			
Violent and sexual offences	2.166	7.434	5.777
Robbery	2.420	8.845	7.385
Vandalism and arson	1.022	3.937	3.109
Theft, burglary and fencing	7.255	17.918	12.439
Drug-related offences	1.983	6.162	4.671
Weapons act	0.704	2.746	2.140

	Mean	Std. Dev.	
		Overall	Within
Threats	0.870	4.438	3.963
HARD CRIMINALS (ALL):*Weighted share (in%) of peers who have served at least 180 days of their lives behind bars ("hard criminals") with past convictions in:*			
Violent and sexual offences	10.195	5.198	4.141
Robbery	6.618	4.914	4.345
Vandalism and arson	5.428	3.366	3.016
Theft, burglary and fencing	21.157	8.352	7.433
Drug-related offences	13.285	5.562	4.955
Weapons act	5.348	3.330	2.973
Threats	3.971	3.520	3.347
STUPID HARD CRIMINALS (YOUNG): *Weighted share (in%) of peers under age 26 who have served at least 180 days of their lives behind bars with past convictions over at least three different incarcerations*			
Violent and sexual offences	7,651	10,693	9,550
Robbery	6,020	9,972	9,395
Vandalism and arson	3,696	5,618	5,382
Theft, burglary and fencing	22,126	21,570	19,745
Drug-related offences	8,022	9,888	9,450
Weapons act	4,139	6,866	6,561
Threats	3,142	6,353	5,829
STUPID HARD CRIMINALS (ALL): *Weighted share (in%) of peers who have served at least 180 days of their lives behind bars with past convictions over at least three different incarcerations*			
Violent and sexual offences	8,321	5,925	5,227
Robbery	5,998	5,348	5,020
Vandalism and arson	5,044	3,913	3,614
Theft, burglary and fencing	22,898	12,936	11,881
Drug-related offences	11,982	7,484	7,188
Weapons act	5,522	4,598	4,289
Threats	4,295	5,171	5,002
CLEVER HARD CRIMINALS (YOUNG): *Weighted share (in%) of peers under age 26 who have served at least 180 days of their lives behind bars with past convictions over at most two different incarcerations*			
Violent and sexual offences	8,686	15,999	13,410
Robbery	7,011	14,904	13,403
Vandalism and arson	2,136	6,502	5,852
Theft, burglary and fencing	12,895	20,407	18,943
Drug-related offences	6,179	13,147	11,869
Weapons act	2,138	5,353	4,815
Threats	1,703	6,992	6,484
CLEVER HARD CRIMINALS (ALL): *Weighted share (in%) of peers who have served at least 180 days of their lives behind bars with past convictions over at most two different incarcerations*			
Violent and sexual offences	12,176	13,548	11,324
Robbery	6,116	9,355	8,480
Vandalism and arson	3,691	6,817	6,475
Theft, burglary and fencing	13,563	13,542	12,937
Drug-related offences	13,994	14,688	13,293

	Mean	Std. Dev.	
		Overall	Within
Weapons act	2,901	5,077	4,802
Threats	2,119	6,104	5,759
WITH AN EDUCATION (YOUNG): *Weighted share (in%) of peers below age 26 who completed an upper-secondary education with past convictions in*			
Violent and sexual offences	16,345	14,261	13,014
Robbery	2,571	6,545	5,671
Vandalism and arson	5,199	7,147	6,579
Theft, burglary and fencing	16,928	14,373	12,801
Drug-related offences	6,793	10,522	9,209
Weapons act	3,520	6,878	6,293
Threats	2,005	5,867	5,544
WITH AN EDUCATION (ALL): *Weighted share (in%) of peers who completed a an upper-secondary education with past convictions in*			
Violent and sexual offences	11,674	7,480	6,088
Robbery	2,170	3,191	2,436
Vandalism and arson	4,604	3,380	3,021
Theft, burglary and fencing	15,946	7,557	6,619
Drug-related offences	9,030	7,567	5,610
Weapons act	3,205	3,553	3,086
Threats	2,446	2,747	2,319
NO EDUCATION (YOUNG:)*Weighted share (in%) of peers below age 26 who did not complete an upper-secondary education with past convictions in*			
Violent and sexual offences	16.320	6.861	5.704
Robbery	5.425	5.393	3.571
Vandalism and arson	6.404	3.826	3.359
Theft, burglary and fencing	25.724	7.371	6.230
Drug-related offences	8.573	4.993	3.895
Weapons act	5.439	3.293	2.728
Threats	3.145	2.656	2.345
NO EDUCATION (ALL): *Weighted share (in%) of peers who did not complete an upper-secondary education with past convictions in*			
Violent and sexual offences	11,990	3,215	2,418
Robbery	4,473	3,368	1,834
Vandalism and arson	5,913	1,914	1,660
Theft, burglary and fencing	21,779	3,620	2,644
Drug-related offences	10,012	3,753	2,036
Weapons act	5,141	2,088	1,525
Threats	3,199	1,546	1,328
OLDER PEERS*: Weighted share (in%) of peers above age 26 with past convictions in*			
Violent and sexual offences	9.953	3.866	2.527
Robbery	3.311	2.604	1.685
Vandalism and arson	5.184	1.955	1.706

	Mean	Std. Dev.	
		Overall	Within
Theft, burglary and fencing	18.160	3.686	3.012
Drug-related offences	9.932	4.191	2.264
Weapons act	4.314	1.962	1.432
Threats	2.912	1.563	1.376
Number of convictions after release (within 12 months)			
Overall	0.941	1.219	1.181
Violent and sexual offences	0.082	0.293	0.287
Robbery	0.012	0.144	0.142
Vandalism and arson	0.033	0.185	0.182
Theft, burglary and fencing	0.376	0.769	0.735
Drug-related offences	0.076	0.301	0.294
Weapons act	0.023	0.161	0.158
Threats	0.023	0.154	0.152
Other offences	0.200	0.400	0.392
Number of convictions after release (within 24 months)			
Overall	1.803	1.915	1.852
Violent and sexual offences	0.161	0.435	0.427
Robbery	0.041	0.205	0.201
Vandalism and arson	0.065	0.261	0.255
Theft, burglary and fencing	0.689	1.179	1.128
Drug-related offences	0.149	0.447	0.435
Weapons act	0.049	0.232	0.226
Threats	0.052	0.238	0.234
Other offences	0.295	0.456	0.449
Number of convictions after release (within 36 months)			
Overall	2.469	2.478	2.393
Violent and sexual offences	0.213	0.519	0.510
Robbery	0.059	0.251	0.247
Vandalism and arson	0.084	0.293	0.287
Theft, burglary and fencing	0.920	1.481	1.415
Drug-related offences	0.226	0.577	0.558
Weapons act	0.068	0.284	0.278
Threats	0.073	0.284	0.279
Other offences	0.332	0.471	0.465

Notes: own calculations based on our sample of young inmates incarcerated for the first time between 1994 and 1997 at the age of 18 to 22. See the main text for more information on the data.

Table A3: Crime-specific peer effects on recidivism (Peer definition II: peers under age 26)

	Dep. var.: Indicator for recidivism with						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Offence X peers_h (β_0)	-0.001	-0.010*	-0.002	0.001	0.031**	0.004	0.018*
	(0.002)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)
No_offence X peers_h (β_1)	-0.000	0.000	-0.003+	0.001	-0.001	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Weighted share (in %) of peers under the age of 26 with past convictions in							
Violent and sexual offences		0.001	-0.001	-0.004	-0.000	0.000	0.000
		(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)
Robbery	-0.001		-0.001	0.002	0.000	0.003*	0.001
	(0.002)		(0.001)	(0.004)	(0.002)	(0.001)	(0.001)
Vandalism and arson	-0.003	0.000		0.003	-0.002	-0.002	0.003+
	(0.003)	(0.001)		(0.004)	(0.002)	(0.001)	(0.001)
Theft, burglary and fencing	-0.002	0.001	-0.003**		0.001	0.000	-0.000
	(0.002)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Drug-related offences	-0.005*	0.003**	0.002	-0.005		0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.003)		(0.001)	(0.001)
Weapons act	-0.000	0.001	-0.001	-0.003	0.007**		0.000
	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)		(0.002)
Threats	-0.001	0.000	-0.001	-0.005	-0.004	-0.001	
	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)	(0.002)	
Criminal behaviour before first incarceration (at least one conviction in offence h, ref. category: other types of offences)							
Violent and sexual offences	0.282	-0.204	-0.168	0.370	-0.559	-0.147	0.061
	(0.592)	(0.325)	(0.432)	(1.057)	(0.542)	(0.321)	(0.291)
Robbery	0.445	-0.072	-0.087	-0.623	-0.263	-0.127	-0.053
	(0.455)	(0.257)	(0.288)	(0.705)	(0.418)	(0.249)	(0.365)
Vandalism and arson	-0.042	0.005	0.114	1.178	-0.535	-0.013	0.194
	(0.505)	(0.217)	(0.525)	(1.285)	(0.466)	(0.276)	(0.291)
Theft, burglary and fencing	-0.086	-0.026	0.059	-1.474+	0.292	-0.028	-0.052
	(0.386)	(0.195)	(0.318)	(0.781)	(0.357)	(0.211)	(0.222)
Drug-related offences	1.005*	0.028	0.090	0.257	-0.075	0.092	0.054
	(0.452)	(0.219)	(0.285)	(0.698)	(0.416)	(0.535)	(0.259)
Weapons act	1.592+	0.069	0.035	0.604	-0.902	0.000	-0.081
	(0.860)	(0.256)	(0.287)	(0.703)	(0.793)	(0.251)	(0.261)
Threats	-1.743**	-0.086	-0.280	-0.926	0.954+	-0.046	-0.615
	(0.618)	(0.217)	(0.392)	(0.959)	(0.569)	(0.481)	(0.507)
Peer characteristics of other inmates at the time of incarceration							
Share of inmates below age 26	-0.434**	0.069	0.048	-0.094	-0.222*	-0.076	0.027
	(0.121)	(0.068)	(0.077)	(0.188)	(0.111)	(0.066)	(0.070)
Share of male inmates	0.071	-0.017	-0.089	-0.157	-0.139	0.137	-0.463*
	(0.334)	(0.189)	(0.212)	(0.519)	(0.307)	(0.183)	(0.193)
Share of inmates of non-Western origin	0.083	-0.003	-0.225	-0.381	0.486*	0.075	-0.141
	(0.235)	(0.133)	(0.149)	(0.364)	(0.216)	(0.128)	(0.135)
Share of inmates non-Danish residents	0.157	0.031	0.212	0.158	-0.470+	0.257	-0.344*
	(0.302)	(0.171)	(0.192)	(0.473)	(0.279)	(0.165)	(0.174)
Share of inmates with a	0.041	0.082	-0.171+	0.240	-0.074	-0.049	0.079

	Dep. var.: Indicator for recidivism with						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
vocational degree	(0.152)	(0.086)	(0.096)	(0.236)	(0.140)	(0.083)	(0.088)
Unemployment rate in the peer's municipality of residence	0.005	0.003	0.004	0.015	-0.011	-0.021*	-0.003
	(0.018)	(0.010)	(0.012)	(0.028)	(0.017)	(0.010)	(0.010)
Overall crime youth conviction rate in the peer's municipality of residence	-0.016	-0.089+	-0.198**	0.041	0.079	0.165**	-0.040
	(0.085)	(0.048)	(0.054)	(0.132)	(0.079)	(0.047)	(0.049)
Socioeconomic individual characteristics in the year of incarceration							
Male	0.047	0.036+	0.027	0.125*	0.032	0.047*	0.035+
	(0.034)	(0.019)	(0.022)	(0.053)	(0.032)	(0.019)	(0.020)
Secondary degree	0.004	-0.008	0.006	0.012	0.001	0.025*	-0.005
	(0.022)	(0.013)	(0.014)	(0.035)	(0.021)	(0.012)	(0.013)
Ethnic Dane	0.014	-0.013	-0.012	-0.031	-0.030+	-0.015	-0.003
	(0.019)	(0.011)	(0.012)	(0.030)	(0.018)	(0.011)	(0.011)
Married	-0.043	-0.045	-0.052	0.182	0.034	-0.030	0.034
	(0.236)	(0.134)	(0.150)	(0.367)	(0.217)	(0.129)	(0.136)
Has at least 1 child under 6	0.021	0.000	-0.005	-0.023	0.016	-0.008	-0.002
	(0.020)	(0.011)	(0.013)	(0.031)	(0.019)	(0.011)	(0.012)
Age	-0.009	-0.008+	0.001	-0.057**	-0.000	-0.003	0.002
	(0.007)	(0.004)	(0.005)	(0.012)	(0.007)	(0.004)	(0.004)
Duration	0.000	0.000	-0.000+	-0.000	0.000+	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Individual characteristics of the municipality of residence in the year of incarceration (averages)							
Log of real income in DKK	1.454	0.659	-1.323+	2.294	-0.578	-0.136	0.162
	(1.087)	(0.615)	(0.690)	(1.688)	(1.001)	(0.595)	(0.628)
Unemployment rate	-0.006	-0.006	0.005	0.023	-0.005	-0.016*	0.016*
	(0.013)	(0.007)	(0.008)	(0.020)	(0.012)	(0.007)	(0.007)
Share of non-Western population	0.008	0.004	0.034*	-0.012	-0.012	0.015	-0.008
	(0.024)	(0.014)	(0.015)	(0.038)	(0.022)	(0.013)	(0.014)
Gini coefficient	-0.172	-0.197	0.551	-1.397	0.473	0.225	0.375
	(0.678)	(0.384)	(0.430)	(1.053)	(0.624)	(0.371)	(0.392)
Crime detection rate	-0.005	0.002	0.004*	-0.002	0.003	-0.000	0.003+
	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)	(0.002)	(0.002)
Youth crime conviction rate	0.011	0.028+	0.002	-0.008	0.032	-0.017	0.013
	(0.029)	(0.016)	(0.018)	(0.045)	(0.027)	(0.016)	(0.017)
Reported crimes per capita	-0.025*	0.000	0.005	-0.039*	-0.004	-0.003	-0.008
	(0.012)	(0.007)	(0.007)	(0.018)	(0.011)	(0.006)	(0.007)
Reported violent crimes per 10,000 inhabitants	-0.058	-0.120	-0.113	0.154	0.140	0.024	0.044
	(0.142)	(0.080)	(0.090)	(0.220)	(0.131)	(0.078)	(0.082)
Number of pupils per class	0.000	-0.007	0.005	0.001	-0.022**	0.015**	-0.001
	(0.009)	(0.005)	(0.006)	(0.014)	(0.008)	(0.005)	(0.005)
Number of police officers per 1,000 inhab.	0.016	0.010	0.020	-0.124	0.139	0.047	-0.158*
	(0.135)	(0.076)	(0.085)	(0.209)	(0.124)	(0.074)	(0.078)
Labour market participation rate	-0.038*	0.003	0.016	-0.053+	-0.005	0.035**	-0.014
	(0.018)	(0.010)	(0.011)	(0.028)	(0.016)	(0.010)	(0.010)
Constant	-14.054	-7.773	15.120+	-22.430	7.588	-1.786	-0.046

	Dep. var.: Indicator for recidivism with						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(13.174)	(7.454)	(8.364)	(20.450)	(12.129)	(7.205)	(7.608)
R-squared	0.353	0.294	0.406	0.424	0.377	0.356	0.314
Observations				1,928			

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Each column represents a different specification. For instance, offence *h* in the two interacted weighted shares of peers (first two rows) is "violent and sexual offences" in column (1). In this table, peers are defined as other inmates below the age of 26. Specifications are simultaneously estimated as a SUR. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1

Table A4: Crime-specific peer effects: by prison duration

	Dependent variable: Indicator for recidivism within 12 months with													
	Panel A: *all peers*							*Panel B: peers under age 26*						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**	**Violent and Sexual offences**	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Offence X peers_h (β_0)	0.004	-0.015	0.001	-0.005	0.055**	0.014	0.010	0.000	0.000	-0.001	-0.000	0.031**	0.006	0.002
	(0.005)	(0.044)	(0.011)	(0.008)	(0.010)	(0.011)	(0.019)	(0.003)	(0.017)	(0.005)	(0.004)	(0.005)	(0.005)	(0.011)
No Offence X peers_h (β_0)	0.001	0.001	-0.002	0.013	0.001	-0.003	0.005	-0.002	0.000	-0.003	0.004	0.001	-0.000	-0.000
	(0.005)	(0.003)	(0.004)	(0.009)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)
Offence X peers_h X more than 30 d. (75 percentile)	-0.012*	-0.000	-0.009	-0.021+	0.029**	0.002	-0.012	0.005	-0.005	-0.002	-0.008	0.041**	0.010	0.004
	(0.006)	(0.016)	(0.011)	(0.011)	(0.007)	(0.009)	(0.020)	(0.004)	(0.014)	(0.006)	(0.006)	(0.007)	(0.007)	(0.012)
No Offence X peers_h X more than 30 d. (75 percentile)	-0.023**	0.002	-0.004	-0.015	0.000	-0.016*	-0.008	-0.002	0.001	-0.000	-0.003	0.002	-0.006+	-0.005
	(0.007)	(0.004)	(0.009)	(0.012)	(0.005)	(0.006)	(0.009)	(0.004)	(0.002)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)
More than 30 d. (75 percentile)	0.191*	0.001	-0.004	0.288	0.029	0.057+	0.047	-0.054	0.005	-0.026	0.060	0.021	0.019	0.038*
	(0.078)	(0.020)	(0.054)	(0.223)	(0.048)	(0.031)	(0.030)	(0.071)	(0.018)	(0.031)	(0.148)	(0.037)	(0.022)	(0.018)
R-squared	0.466	0.340	0.455	0.501	0.469	0.391	0.367	0.466	0.343	0.457	0.496	0.479	0.388	0.366
Observations	1,430							1,430						

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Each column represents a different specification. For instance, offence *h* in the interacted weighted shares of peers is "violent and sexual offences" in column (1). The sample excludes individuals who serve more than 365 days behind bars and who are transferred across facilities for more than a tenth of their total serving time. Specifications include controls for individual characteristics, municipality characteristics and dummies, peer characteristics, facility fixed effects, time fixed effects, and facility-by-prior-offense fixed effects. Specifications in each panel are simultaneously estimated as a SUR. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table A5: Crime-specific peer effects: by type of prison

	Dependent variable: Indicator for recidivism within 12 months with													
	Panel A: Peer definition I: *all peers*							*Panel B:Peer definition II: Peers under age 26*						
	Violent and Sexual offences	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**	**Violent and Sexual offences**	**Robbery**	**Vandalism and arson**	**Theft, burglary and fencing**	**Drugs**	**Weapons**	**Threats**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Offence X peers_h (β_0)	-0.018*	-0.023	0.002	-0.004	0.014	0.003	0.021	-0.002	-0.008	-0.003	0.009+	0.026**	0.003	0.005
	(0.007)	(0.020)	(0.012)	(0.013)	(0.016)	(0.012)	(0.020)	(0.003)	(0.009)	(0.005)	(0.005)	(0.006)	(0.005)	(0.008)
Offence Xpeers_h X closed	0.014	0.001	0.149**	0.040	-0.014	0.018	0.136**	0.001	-0.006	0.038	0.008	0.052*	0.010	0.111**
	(0.009)	(0.023)	(0.036)	(0.038)	(0.028)	(0.032)	(0.039)	(0.006)	(0.011)	(0.027)	(0.016)	(0.022)	(0.013)	(0.025)
Offence X peers_h X local	0.019+	0.018	-0.063**	-0.007	0.081**	-0.010	-0.061	0.002	0.013	-0.000	-0.013*	0.007	-0.002	-0.055
	(0.011)	(0.032)	(0.022)	(0.015)	(0.023)	(0.023)	(0.083)	(0.005)	(0.018)	(0.009)	(0.006)	(0.010)	(0.011)	(0.160)
Closed prison	1.124	-5.767		0.106	3.878		-0.668	-14.377	-6.062	-	-15.002	-	-	-
	(0.984)	(7.498)		(1.283)	(9.186)		(0.679)	(13.263)	(5.601)		(15.350)			
Local prison	1.868+	-5.958	12.988	0.313	6.046	-0.220	-0.732	-13.935	-7.982	15.072+	-19.608	6.324	-0.072	0.172
	(1.043)	(7.499)	(8.317)	(1.374)	(12.241)	(7.221)	(7.593)	(13.255)	(7.451)	(8.353)	(20.436)	(12.155)	(0.479)	(7.575)
Open prison				Ref.							Ref.			
R-squared	0.358	0.293	0.417	0.427	0.374	0.360	0.322	0.353	0.297	0.408	0.427	0.379	0.356	0.321
Observations				1,928							1,928			

Notes: The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. Each column represents a different specification. For instance, offence *h* in the interacted weighted shares of peers is "violent and sexual offences" in column (1). *Closed*, *local*, and *open* refer to the type of prison where an individual serves her longest spell. Specifications include controls for individual characteristics, municipality characteristics and dummies, peer characteristics, facility fixed effects, time fixed effects, and facility-by-prior-offense fixed effects. For simplicity, we only show results for reinforcing peer effects (β_0) in this table. Specifications in each panel are simultaneously estimated as a SUR. Standard errors are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Table A6: Participation rates in rehabilitation programmes

Time spent in prison	Participation rates	N
Less than 1 month	0.202	109
Between 1 and 2 months	0.244	41
Between 2 and 3 months	0.414	29
Between 3 and 4 months	0.500	72
More than 6 months	0.534	442

Note: The data is this table come from a 2007-2009 survey conducted in Danish prison by (Minke 2010) and are presented in Landersø (2015, p15). Rehabilitation programmes include treatment for drug and alcohol abuse, anger management therapy and cognitive behaviour therapy.

Table A7: Crime-specific peer associations (peers under the age of 26) with recidivism within 12 months: OLS estimations with all 12 offence categories

	Dep. var.: Indicator for recidivism with											
	Violent and Sexual offences	**Decency and child pornography**	**Threats**	**Falsification, fraud and tax evasion**	**Vandalism and arson**	**Theft, burglary and fencing**	**Robbery**	**Drugs**	**Traffic offences**	**Weapons**	**Tax acts and other special acts**	**Other and unknown offences**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Offence X peers_h (β_0)	0.000	0.000	0.000	-0.004	-0.006*	0.014*	-0.007	0.029*	0.009	0.004	-0.012	0.027*
	(0.004)	(0.000)	(0.000)	(0.005)	(0.003)	(0.006)	(0.008)	(0.014)	(0.007)	(0.007)	(0.017)	(0.012)
No_offence X peers_h (β_1)	0.002	0.000	0.000	-0.003	-0.006+	0.013*	0.001	-0.001	0.007	-0.002	-0.006	0.000
	(0.004)	(0.000)	(0.000)	(0.003)	(0.003)	(0.006)	(0.002)	(0.005)	(0.005)	(0.003)	(0.005)	(0.004)
Individ. charact.	YES											
Municipality charact.	YES											
Peer characteristics	YES											
Time fixed effects	YES											
Facility fixed effects	YES											
Facility-by-prior-offence fixed effects	YES											
R-squared	0.414	-	0.370	0.424	0.470	0.481	0.358	0.434	0.473	0.401	0.451	0.379
Observations	1,928											

Notes: Each column represents a different specification. For instance, offence *h* in the two interacted weighted shares of peers is "violent and sexual offences" in column (1). In this table, peers are defined as other inmates below the age of 26. OLS estimations. The dependent variable is an indicator for whether an individual is convicted of offence *h* within 12 months after release. In this table, peers are defined as other inmates below the age of 26. "Individ. charact." include criminal history and socioeconomic variables. "Municipality charact." refers to a set of controls for the individual's municipality characteristics (at the time of incarceration) and municipality dummies. "Peer characteristics" refers to weighted shares of peers convicted of each of the off-diagonal offences, controls for weighted share of co-inmates in particular demographic groups: under the age of 26, of non-Western origin, non-Danish residents, male, who have completed an upper-secondary education degree, and controls for peers' municipality characteristics such as average unemployment rate and average youth crime conviction rate. Robust standard errors clustered at the facility level are in parentheses. **: p<0.01, *: p<0.05, +: p<0.1.

Construction of exposure to peers (extended).

In practice, we construct individual i's exposure to peers with a criminal history in offence h in three steps. First, for each facility j and for any period τ_j in which the peer composition is unchanged, we calculate the share of inmates with a criminal history in offence h as the number of inmates who have been convicted of offence h divided by the total number of inmates. Second, for each individual i in our sample we construct the share of peers in period τ_j who have a criminal history with offence h by leaving out individual i's own criminal history from the calculation of the share of inmates in facility j in period τ_j who have been convicted of offence h. Third, for each individual i we calculate the sum of the weighted shares of peers in period τ_j with a criminal history in offence h over the entire duration of incarceration of individual i where the share of peers in period τ_j with a criminal history in offence h is weighted by the length of period τ_j relative to the length of the incarceration spell of individual i, $t\text{-}t_0$. Thus, individual i's relative time-serving overlap with peers who have a criminal history in offence h is constructed as the sum of the shares of peers in period τ_j who have a criminal history in offence h weighted by the duration of the period τ_j relative to individual i's duration of incarceration.