

The Market for Crime

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Abstract: I investigate the effect of inmates exiting prison and re-entering the criminal market on the criminal activity of their crime partners and other individuals operating in that market. I use unique administrative data, which allows me to identify criminal partners as individuals who have been convicted for crimes committed together in the past. My identification strategy exploits that those individuals who experience the release of a crime partner (or competitor) from prison at different times would have been likely to follow the same crime trajectory, had they not experienced such a release. I show that the release of inmates from prison leads to an immediate increase in the crime rates of their criminal partners, which lasts for at least 12 months following release. Finally, I show suggestive evidence that the release of inmates from prison also increase the criminal behavior of non-network members who operate in the same market. This suggests that the re-entry of offenders to the criminal market increase crime through both reversed incapacitation, spillover effects to network members and market level externalities, such as a stretch of police resources or competition, imposed on other offenders operating in that market.

Keywords: Crime spillovers, networks, incarceration, peer effects

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1 Introduction

Incarceration prevents crime not only by removing the criminally active from the criminal market, but also by any effects this removal has on the criminal behavior of other individuals. Incarcerating one offender may affect the criminal behavior of individuals in the inmate's criminal network, as well as the criminal behavior of other individuals operating in the same market by changing, for instance, their probability of apprehension or by freeing up space in the market. Given that such spillover effects have the potential to amplify or mute the costs and benefits associated with incarceration, quantifying these effects are important in order to evaluate the effectiveness of criminal justice policies.

This paper investigates the importance of such spillover effects by studying the criminal behavior of criminal partners of incarcerated offenders and other individuals operating in the same market as incarcerated offenders in the period surrounding their release from prison.

I use detailed individual level administrative data which includes complete incarceration, and crime histories of all individuals residing in Denmark at a monthly frequency from 1992 to 2012. The data includes information on individuals who have been convicted for the same crime in the past, which I use to identify crime partners. Furthermore, it includes information on the municipality of residence of incarcerated offenders, and a broad range of demographic and crime characteristics of all individuals residing in Denmark, which I use to define the main criminal market in which offenders operate and to identify crime prone individuals operating in that market independently of the released inmate.

I first investigate how the release of an inmate from prison affects the criminal behavior of his criminal partners who are not incarcerated at the time of release. My identification strategy compares the criminal behavior of individuals who experience the release of a crime partner from prison today, with the criminal behavior of other individuals who experience the release of a partner at a different time. The key identifying assumption is that individuals who experience the release of a criminal partner from prison at different times would have followed the same trend in criminal behavior, had they not experienced the release of a crime partner.

I show that the release of one inmate from prison leads to an immediate increase in the monthly probability that their partners commit any crime with 1 pp or 15.6% relative to the mean in each of

the 12 months following their release. This is a large effect corresponding to an increase of approximately 15% of the increase in the inmates own criminal behavior.

The richness of the data allows me to characterize inmates and their partners along various margins, such as their past crime history and demographic characteristics (where they live, their age, gender, education, etc.). I use this information to investigate the mechanisms leading to spillover effects of inmate release to crime partners and whether the effect size varies with how connected individuals are within the same crime networks.

I show that inmates who were incarcerated for committing a property or violent crime have larger effects on their partners' criminal behavior within these exact crime categories (surprisingly this is not the case for drug crime). Furthermore, I show that crime partners, who have committed property crime or violent crime with the inmate in the past, increase their crime propensity in these exact crime categories the most upon the release of the inmate from prison. I interpret these results as suggestive evidence of specialization of inmates within specific crime types and complementarities in the production of crime between inmates and their criminal partners driving a part of the observed increase in crime of crime partners.

Finally, I show that the effects are twice as large for individuals who experience the release of a crime partner from prison who have the same gender, resides in the same municipality (pre incarceration), who are similar in age and who are from the same origin country. I interpret this as evidence of within network spillovers being larger between people who are better connected.

Having shown that the release of inmates increase crime not only through their own crime, but also through the effect of their release on the criminal behavior of their partner, I next investigate how their release and the associated increase in crime affects the criminal behavior of other individuals operating in the same market. I do so by constructing a sample of individuals who has a high estimated risk of committing crime, but who have a low estimated probability of co-offending with the released inmates (the results are still very preliminary and not included here). I find some suggestive evidence that non-network members who are likely to operate in the same market also increase their criminal behavior as a response to the release of inmates from prison.

This paper contributes to the understanding of incarceration and in particular the understanding of how incarceration affects crime. To the best of my knowledge, this is the first paper to document effects of incarceration on crime reaching beyond the impact of incarceration on inmates (see for

instance, Mueller-Smith, 2015; Rose and Shem-Tov, 2021 and Bhuller et al., 2020) and individuals in their network (Bhuller et al., 2018; Philippe, 2017).¹ The paper further contributes to the literature on peer effects in criminal behavior. While existing studies have documented the presence of peer effects in criminal behavior using quasi random assignment of individuals to peer groups (Bayer, Hjalmarsson and Pozen, 2009; Billings and Schnepel, 2017; Damm and Dustmann, 2014), I revert the experiment by studying how the criminal behavior of peers are affected by reinserting crime prone individuals in the network.² These effects are closely linked to incarceration, which is a common policy tool used to control crime rates. Closely related to this study are also a few recent studies documenting the importance of behavioral spillovers in criminal behavior, by showing how changes in the criminal behavior of one offender due to an exogenous event affect the criminal behavior of individuals in their network (Dustmann and Landersø, 2021; Bhuller, Dahl, Løken and Mogstad, 2018; Drago and Galbiati, 2012).³ Rather than studying how changes in the behavior of one individual affects the behavior of peers, I study how reinserting crime prone individuals in their criminal network affects the criminal behavior of their peers. Furthermore, I add to this branch of the literature by studying the effects of incarceration on non-network members. Finally, this paper is related to the literature estimating how changes to the prison population size affect crime rates (Levitt, 1996; Marvell and Moody 1994; Johnson and Raphael, 2012) and the literature identifying the incapacitation and deterrence effect of incarceration (Barbarino and Mastrobuoni, 2014; Buonanno

¹ Mueller-Smith (2015) and Bhuller et al. (2020) use variation in judges propensity to incarcerate to estimate the effect of incarceration on recidivism and labor market outcomes following release in the US and Norway, respectively. Mueller-Smith show that incarceration increases recidivism and worsen labor market outcomes in the US, while Bhuller and co-authors show evidence of incarceration decreasing recidivism and increasing labor market attachment following release in Norway. Rose and Shem-Tov (2021) exploits discontinuities in sentencing guidelines creating discrete changes in the average incarceration length of convicted offenders based on scores. They show that longer incarceration spells are associated with a decrease in recidivism rates. Bhuller et al. (2018) use the same design as Bhuller et al. (2020) to show that incarceration of one offender decreases the crime rate of individuals belonging to the criminal network of the incarcerated offender.

² Damm and Dustmann (2014) show that quasi-random assignment of refugee children to neighborhoods with a higher share of criminals leads to an increase in the criminal behavior of assignees in adulthood. Bayer, Hjalmarsson and Pozen (2009) show how the criminal behavior of juveniles are affected by the characteristics of their cellmates in juvenile correctional facilities, while Billings and Schnepel (2017) show that an increase in number of criminal peers who are incarcerated upon release from prison is associated with a decrease in recidivism rates.

³ Dustmann and Landersø (2021) show that young men fathering a boy as opposed to a girl are convicted for significantly fewer crimes in the subsequent years and that this leads to a reduction in crime convictions among other young men residing in the same neighborhood. Bhuller et al. (2018) show that incarceration, as opposed to alternative sanctions, are associated with a decrease in crime among incarcerated offenders using quasi-random variation in judges' propensity to incarcerate as an instrument. They further show that this leads to a reduction in the criminal behavior of individuals in the criminal and family network of the incarcerated offender. Drago and Galbiati (2012) exploit a large prison pardon scheme in Italy that converted actual sentences to expected sentences upon reoffending to show that individuals decrease their criminal behavior in response to increases in residual sentences of their peers.

and Raphael, 2013; Kessler and Levitt, 1999). I contribute to this literature by highlighting network effects and market level effects as key mechanisms through which imprisonment may affect crime.

The remainder of this paper is structured as follows. Section 2 describes the data and sample selection, Section 3 describes the empirical strategy, Section 4 describes the results and finally Section 5 concludes.

2 Data

My analysis is based on individual level data covering the entire Danish population, contained in various registers collected and provided by Statistics Denmark. A key feature of the data is an individual level identifier that allows me to link information from different administrative registers to the same individual. Specifically, I use prison registers to identify individuals released from prison and police registers to identify their criminal partners, reported crimes, criminal charges, and criminal convictions. Furthermore, I use various demographic registers to obtain information on the demographic characteristics of inmates and their crime partners.

2.1 Inmates and Network Members

I identify prison inmates from the prison registers. The prison registers include information on the date of incarceration, the date of release, the prison in which the sentence is served and a unique case number at the individual level for all incarcerations in Denmark between 1992 and today. The unique case number refers to a reported crime and allows me to follow a reported crime through each step of the criminal justice system from reporting to individuals being charged with and convicted for the criminal offence and finally who, if any, is incarcerated for having allegedly committed the crime. I use the case number to identify the type of crime that leads to incarceration and when inmates were convicted. I focus on releases from prison occurring between 1996 and 2012 and in particular the date of release, which is the main event of interest. I exclude releases occurring after an arrest and other very short incarceration spells (less than 90 days).

Having identified the releases from prison, I identify criminal partners of released offenders using information from police registers on individuals who are convicted for the same crime. That is, individuals who are convicted within the same case number. For each release event I identify criminal partners of the released offenders as individuals they have been convicted together with for crimes committed in the 5 years leading up to their incarceration. From this set of partners, I exclude criminal partners who are released in the same month and those who are in prison when the focal offender is

released from prison.⁴ I impose the first restriction to avoid contaminating the effect of the release of a criminal partner with the effect of own release and the latter since those incarcerated are unable to react to the release of the focal offender from prison. I further exclude release events if the released offender has no observed partners.

This leads to a sample consisting of 89,467 partners for a total of 28,946 release events of 16,517 unique inmates between 1996 and 2012 that occur at a fairly stable rate throughout the observation period, see Appendix Figure A1. Table 1 show characteristics of the release events, inmates and their partners. Offenders are relatively young, most are men and a relatively large share are immigrants. Most of the releases occur after a prison spell of between 90 and 180 days, whereas fewest occur after a prison spell of more than 2 years. The most common crime leading to incarceration is a property crime, among which robbery is the most common crime types. The average number of criminal partners is 3, with the majority having just partner (see Appendix Figure A2).

Table 2 show measures of the similarity between inmates and their partners relative to the similarities that would occur if inmates and partners were randomly matched. Criminal partners exhibit a strong pattern of homophily, with individuals being much more likely to commit crime with individuals of the same gender, similar age, same origin country and with other immigrants. Inmates are also much more likely to have criminal partners who reside in the same municipality.

For the analysis below, I arrange criminal partners of newly released inmates in a monthly level panel in the period surrounding the release of the inmate. In particular, I include partners from the date the inmate is incarcerated (or a maximum of 24 months prior to incarceration) until 24 months after the inmate's release.

2.2 Outcomes

My main outcome of interest is the criminal behavior of criminal partners, and in particular how their criminal behavior varies in the period surrounding the release of one of their criminal partners from prison. I measure criminal behavior as crimes leading to a charge and I use information on the date a crime is committed to assign a crime to the relevant month.⁵ My main outcome variable of interest is

⁴ Yy criminal partners are released in the same month as the focal offender and xx are in prison themselves at the time of release.

⁵ Arrests, a crime measure used in most US studies, are not common in Denmark. According to the Danish "Law on Administration of Justice" (Retsplejeloven, Article 755, part 1), a person should be arrested only if considered necessary to prevent further criminal offenses, and arrests should not be contemplated if a disproportionate measure in regard to the nature of the offense.

then a dummy equal to one if the individual commits at least one crime in a given month. Alternatively, I use the number of crimes committed in a month leading to a charge as well as the number of crimes leading to a conviction. Table 3 shows descriptive statistics of various crime variables for inmates and their crime partners in the period following the release of the inmate from prison. Within the first 24 months of release 76% of inmates have committed at least one new crime for which they are eventually charged, and 69% have committed a new crime for which they are eventually convicted. The most common crime types are property and drug crimes. The pattern is similar for the criminal partners of inmates, although their crime rates are slightly lower. Among criminal partners 53% (46%) have committed at least one crime eventually leading to a charge (conviction).

3 Empirical Strategy

To identify the effect of inmates being released from prison on the criminal behavior of their crime partners, I rely on variation in the timing of when releases occur in a simple event study specification, specified as in Equation (1).

$$C_{it(j)} = \sum_{k \neq -1} \delta_k \times 1[t - R_j = k] + f_i + f_t + u_{it(j)} \quad (1)$$

In (1) $C_{it(j)}$ is a dummy equal to one if individual i , who is a criminal partner of inmate j , commits at least one crime in month t for which he is eventually charged (alternatively it refers to the number of crimes or crime leading to conviction). $1[t - R_j]$, is an indicator equal to one k periods after the release of focal offender j from prison, which occurs at time R_j . Finally, f_i and f_t are individual and time fixed effects respectively. The key parameters of interest are the δ_k 's. In the absence of individual and time fixed effects δ_k identifies the change in the probability that criminal partners commit any crime k periods after the release of inmate j , relative to a baseline period, which I choose as the month before the release of inmate j . I bin the endpoints at 13 months before and 13 months after the release of the inmate. Intuitively, this strategy essentially compares the change in criminal behavior of individuals who had a crime partner released from prison, with the change in the criminal behavior over the same period for individuals who experience the release of a criminal partner in another period. The key assumption for δ_k to have a causal interpretation is that individuals who experience the release of an inmate in the criminal network at different times would have followed

the same trend in the absence of such release. While this assumption cannot be directly tested, I provide evidence in favor of this assumption by showing that δ_k 's are close to 0 for all $k < 0$.⁶

While estimates from Equation (1) allows me to understand the dynamic effect of inmates being released from prison on the criminal behavior of their crime partners I also want to estimate the average effect over the full 24 months following the release. To estimate the average effect of inmates being released from prison over the subsequent 24 months I also estimate the following specification,

$$C_{it(j)} = \bar{\delta} \times 1[t - R_j > 0] + f_i + f_t + e_{it(j)} \quad (2)$$

where $1[t - R_j]$ is a dummy equal to one for months occurring after the inmate is released from prison. $\bar{\delta}$ is the parameter of interest and identifies the average monthly effect of inmates being released from prison on the criminal behavior of their crime partner. The key identifying assumption is the same as for Equation (1), namely that individuals experiencing the release of a crime partner from prison at different times would have followed the same trend in criminal behavior had the partner not been released.⁷

4 Results

4.1 Release from Prison and Crime of Inmates

I first investigate how the criminal behavior of inmates change in the period surrounding their release from prison. If inmates themselves do not commit crime upon their release from prison, there is little reason to believe that their release should affect the criminal behavior of their criminal partners or other individuals for that matter.

To do so I estimate regressions analogue to Equation (1), but where the dependent variable is a dummy equal to one if the released inmate commits at least one crime in a given month for which he

⁶ By restricting δ_k to be constant across individuals who experience the release of a crime partner at different times I do not allow for heterogeneous effects by the time of treatment. Abraham and Sun (2022) show that this can lead to contamination of the δ_k estimates if there are indeed heterogeneous treatment effects. I show this does not appear to be the case in my setting (to be done).

⁷ By restricting $\bar{\delta}$ to be constant across individuals experiencing the release of a crime partner at different times as well as by time since the release, this specification does not allow for heterogeneous treatment effects by the period in which individuals are treated, nor by time since treatment. As shown in Goodman-Bacon (2022) this can lead to a biased estimate of $\bar{\delta}$ if there are indeed heterogeneous treatment effect. I show graphically that there is little evidence of heterogeneous treatment effects by time since treatment.

is later charged.⁸ Figure 1 show the estimated δ_k 's for inmates spending between 1 and 2 years incarcerated in panel (a) and for inmates spending more than 2 years incarcerated in panel (b). As one would expect there is no trend in the probability that inmates commit crime in the period leading up to their release from prison, which is natural, sine they are incarcerated. In the first full month following release, the probability that inmates commit at least one crime increases by 9 pp for inmates who served a prison spell of 1-2 years and by 5 pp for inmates who served a prison spell of more than 2 years and there is little evidence that the effect decreases as time passes since release. The effects are large and corresponds to an increase of 78%-141% relative to the mean crime rate among the partners of inmates (using inmates own mean is not meaningful, since it is mechanically 0 in the pre-release period).

4.2 Release from Prison and Crime of Criminal Partners

Having shown that inmates begin to commit crime in the month of their release, I next investigate how the release of inmates from prison affects the criminal behavior of their criminal partners. Figure 2 show the estimated δ_k 's from estimating Equation (2) when the dependent variable is a dummy equal to one if the criminal partner commits at least one crime for which he is later charged in a given month. Again, I show estimates separately for partners of inmates spending between 1-2 years incarcerated in panel (a) and for partners of inmates spending more than 2 years incarcerated in panel (b).

In both panels there is little evidence of any pre-trend with all δ_k 's for $k < 0$ being close to 0 and insignificant, lending support to the assumption that partners of inmates released from prison at different times would have followed the same trend in criminal behavior had the inmate not been released.

Upon the release of the inmate from prison, at time 0, there is an immediate increase in the probability that the criminal partners commit any crime of approximately 1.4 pp for both groups. The increased crime propensity continues to be at a higher level for each of the 12 months following the inmates release from prison. Table 4 shows estimates, from Equation 2, of the average effect of releasing one inmate from prison on the criminal behavior of his crime partners by the type of crime they commit.

⁸ In particular I estimate: $C_{jt(j)} = \sum_{k=-1} \delta_k 1[t - R_j = k] + f_j + f_t + u_{jt(j)}$, where $C_{jt(j)}$ is a dummy equal to one if inmate j commits at least one crime in month t for which he is eventually charged.

Estimates from Table 4 show that the release of one inmate from prison leads to an increase in the average monthly probability that partners commit any crime of 0.1 pp or 15.6% relative to the sample mean. This increase is significant for all crime types, but particularly large for violent crime. Focusing on the effect of releasing an inmate serving between 1 and 2 years in prison, their release increases the monthly probability that partners commit any violent crime by 33.3%, any property crime by 21%, any drug crime by 21% and any other crime by 31%.

Table A1 show the estimates effect of having a criminal partner released from prison, on individuals criminal behavior using alternative measures of criminal behavior. Column (1) replicates column (1) of Table 4, column (2) uses the number of crimes leading to a charge as the dependent variable, column (3) uses a dummy equal to one if the individual commits any crime in a given month that leads to a conviction and column (4) uses the number of crimes committed in a given month leading to a conviction. The release of a crime partner from prison leads to an average monthly increase in the number of crimes leading to a charge of 0.037 crimes if the partner serves 1-2 years incarcerated and 0.026 crimes if the partner serves more than 2 years incarcerated, 0.007 leading to a conviction.

Thus, having an inmate released from prison increases crime not only via reversed incapacitation, but also by a spillover effect of their release on the criminal behavior of their crime partners.

4.2.1 Why do Crime Partners Respond

One natural question to ask is then why individuals react to the release of a criminal partner by increasing their criminal behavior. One explanation is that inmates and their partners are complementary in the production function of crime. I investigate the likelihood of this explanation in two ways. First, I investigate if inmates incarcerated for a particular crime type affect the criminal behavior of crime partners in that particular crime category more. Second, I investigate if the type of crime that inmates and their partners were convicted for having committed together in the past affects the effect of inmates' release on the criminal behavior of their partners more within that particular crime category.

Table 5, show estimates of the average effect of releasing one inmate from prison on the criminal behavior of his crime partners, by the type of crime that led to the incarceration of the inmate in the first place. Inmates incarcerated for committing a property or violent crime appear to increase the criminal behavior of their partners most within exact categories, although magnitude are similar

across types. For instance, individuals experiencing the release of a partner from prison who was incarcerated for a property crime increase their property crime propensity with 1 pp compared to the 0.7 pp increase in the property crime propensity among individuals experiencing the release of a partner incarcerated for a violent crime.

The pattern is less clear for inmates incarcerated for drug crimes and other crimes. One reason for this could be that drug crime includes both individuals incarcerated for sales and possession of drugs. Table 5 provides some evidence that inmates may be specialized within particular crime types and their release increase the criminal behavior of their crime partners most within these categories. If inmates and their partners are, however, complementary in the crime production function we may expect this to be more pronounced within one type of crime.

To investigate this, Table 6 show estimates of the average effect releasing one inmate on the criminal behavior of his crime partners by the type of crime I observe them committing together in the past. The pattern in Table 6 is similar to that of Table 5. That is inmates increase the criminal behavior of their partners most, within the exact crime category they have been convicted for committing together in the past for those convicted for property and violent crimes.

Together these results provide some suggestive evidence that individuals increase their crime propensity as a response to the release of a partner from prison, because they are complementary in the production of crime, which leads to an increased expected return from committing crime.

4.2.2 Which Crime Partners Respond

I next investigate if individuals respond more to the release of a crime partners from prison who are more like them, in terms of their observable characteristics. If individuals within the same network are more connected to individuals who are similar to themselves, differential effects by similarity may suggest that there are heterogeneous effects by how connected individuals within the same network are. Table 2, for instance, shows that individuals in the same network exhibits a strong pattern of homophily when choosing their crime partners.

To investigate this further I restrict the sample to criminal partners who are similar to the released inmate in terms of their gender, age, municipality of residence and origin country. I show the results from this exercise when I impose a battery of these restriction simultaneously in Table 7, and one by

one in Appendix Table A2. Column (2) of Table 7 show that crime partners who have the same gender, are no more than 2 years older or younger than the released inmate, and who reside in the same municipality at the time of incarceration respond much stronger to the release of their crime partner from prison. For this group, their monthly probability of committing a crime increases by 2 pp when their crime partner is released from prison, which is double the estimated effect for the full sample of partners (1 pp as shown in column (1)). Restricting this group even further, to be less than 1 year apart in age and from the same origin country increase the estimate even further. Together these results suggests that individuals within the same crime network respond stronger to the release of crime partners who are similar to themselves, which may serve as a proxy of how connected individuals in the same network are. This result is important, since it suggests that incarcerating individuals belonging to the same network may have very differential effects on the crime of their partners, depending on their position in the network and their similarity and connectivity with other individuals in the network.

4.2.2 Release from Prison and Crime of Fake Partners

I next provide some evidence that the effect of releasing inmates from prison on the criminal behavior of their peers is not simply due to spurious correlations between the timing of when inmates are released and other shocks to crime, that are common to all offenders. To do so I randomly assign the criminal partners used up until now to inmates, creating fake criminal partners of inmates. I then re-estimate the main specification in Equation (1) using this sample instead. The resulting estimates are shown in Appendix Figure A3 and show no evidence of a relationship between the release of inmates from prison and the criminal behavior of their fake partners, with all estimates being essentially 0.

4.3 Release of Inmates and Crime of Non-Network Members

Up until now I have documented that the release of inmates from prison increase crime because inmates themselves begin to commit crime upon release from prison (reversed incapacitation), but also through an increase in the criminal behavior of their crime partners (spillovers to network members).

The re-entry of inmates into the criminal market and the associated increase in the crime of their criminal partners may also affect the criminal behavior of other individuals who operate in the same

market. This could, for instance, be the case if police resources are fixed and police now spend more time clearing the crimes committed by inmates and their partner, or due to new competition arising in the market.

I next investigate the presence of such spillover effects to non-crime partners who operate in the same market as released offenders. To do so I first show how releasing offenders to a municipality affects the crime rate in the municipality. I then try to decompose the change in crime at the municipality level into effects due to reversed incapacitation, changes in the crimes committed by individuals who are likely to commit crime with released inmates and finally individuals who are unlikely to commit crime with newly released inmates.

4.3.1 Municipality Level Crime and Incarceration

To estimate the effect of prison outflows in the municipality specific crime rates I first construct a municipality level panel, where municipalities are observed at a monthly frequency from 1996 to 2012. There are a total of 275 municipalities in Denmark during this period. I then estimate a municipality level version of Equation (2) as displayed in Equation (3),

$$C_{jt} = d^l Inc_{jt} + d^r Rel_{jt} + f_{jy} + f_t + r_{jt} \quad (3)$$

Where C_{jt} is the number of reported crimes committed in municipality j during month t per 100 residents, and Inc_{jt} and Rel_{jt} are the cumulative prison inflows and outflows in the beginning of month t since the beginning of 1996, also per 100 residents. f_{jy} and f_t are municipality by year and time fixed effects (month by year). I weight each municipality with their population size in the base period. As before the key identifying assumption is that municipalities experiencing releases of offenders at different times would have followed the same trend in their crime rates had they not experienced differential release patterns.

Figure 3 show the estimated effect of releasing one offender per 100 residents on the number of reported crimes per 100 residents by months since the release. There is no trend in the crime rate leading up to the release event, with all coefficients being small and close to 0. In the month of release

the crime rates immediately increases to approximately 0.6, where it remains stable for the subsequent 10 months.⁹

Table 5, show estimates of the average effect of prison outflows on the municipality crime rate estimated using Equation (3). In line with Figure 3, the release one offender per 100 residents leads to an increase in the monthly crime rate of approximately 0.6 crimes per 100 residents. As illustrated in Sections 4.1 and 4.2 the increased crime rates associated with the release of offenders from prison is likely due to a combination of reversed incapacitation and increases in the criminal behavior of criminal partners of released offender. What remains unclear is if the change in crime at the municipality level is also affected by changes in the criminal behavior of other individuals who are not committing crime together with the released offender, but who may be affected via market level externalities.

4.3.2 Identifying Competitors

To estimate the effect of inmates being released from prison on individuals who does not belong to the criminal network of inmates, I first need to identify these individuals. Since my measure of crime partners is unlikely to include all individuals in an inmate's network using all non-network members is unlikely to be a good strategy.

Instead, I use the observed co-offending patterns to construct a measure of the probability that two offenders belong to the same network. Using this measure, I identify individuals who are likely to co-offend, but unlikely to co-offend with the released inmate. Hence, we can think of these as crime prone individuals who operate independently of the released inmate and who may be a direct competitor.

4.3.3 Incarceration, Reversed Incapacitation, Network and non-Network Members

⁹ Estimates are retrieved from a dynamic version of Equation (3) where we include leaded and lagged prison in and outflows as regressors.

5 Conclusion

Incarceration is a common crime prevention tool, that prevents crime by incapacitating the criminally active. Incarceration of one offender may also, however, affect the criminal behavior of other individuals affected by the removal of the offender from the market, such as, their co-offenders. By amplifying or muting the costs and benefits of incarceration, such spillover effects may drastically alter the evaluation of criminal justice policies.

This papers, shows that such spillovers are indeed present, by identifying the effect of inmates being released from prison on the criminal behavior of their crime partners and other individuals operating in the same market using an identification strategy that compares the criminal behavior of individuals who experience the release of a crime partner at different times.

I show that individuals increase their criminal behavior dramatically as a response to the release of one of their criminal partners from prison and that these effects persist for at least 12 months. I show suggestive evidence that the response is likely to arise at least and part due to complementarities between inmates and individuals in their crime network in the production of crime. I further show suggestive evidence that the effects are stronger among individuals who are more similar in terms of their observable characteristics, which I think of as a proxy of how connected individuals belonging to the same crime network are.

Finally, I investigate if the release of inmates from prison and the associated increase in crime affects the criminal behavior of non-network members operating in the same market.

Together these results contribute to the knowledge about how incarceration affects crime, and in particular the mechanisms that are driving the decrease in crime associated with higher incarceration rates (Levitt, 1996). The results suggests that a non-negligible part of the reduction in crime associated with incarceration is due to spillover effects to other individuals affected by the removal of the incarcerated individual.

References

- Barbarino, A., & Mastrobuoni, G. (2014). The incapacitation effect of incarceration: Evidence from several Italian collective pardons. *American Economic Journal: Economic Policy*, 6(1), 1-37.
- Bayer, P., Hjalmarsson, R., & Pozen, D. (2009). Building criminal capital behind bars: Peer effects in juvenile corrections. *The Quarterly Journal of Economics*, 124(1), 105-147.
- Bhuller, M., Dahl, G. B., Løken, K. V., & Mogstad, M. (2018). *Incarceration spillovers in criminal and family networks* (No. w24878). National Bureau of Economic Research.
- Bhuller, M., Dahl, G. B., Løken, K. V., & Mogstad, M. (2020). Incarceration, recidivism, and employment. *Journal of Political Economy*, 128(4), 1269-1324.
- Billings, S. B., & Schnepel, K. T. (2020). Hanging out with the usual suspects: Neighborhood peer effects and recidivism. *Journal of Human Resources*, 0819-10353R2.
- Buonanno, P., & Raphael, S. (2013). Incarceration and incapacitation: Evidence from the 2006 Italian collective pardon. *American Economic Review*, 103(6), 2437-65.
- Damm, A. P., & Dustmann, C. (2014). Does growing up in a high crime neighborhood affect youth criminal behavior?. *American Economic Review*, 104(6), 1806-32.
- Drago, F., & Galbiati, R. (2012). Indirect effects of a policy altering criminal behavior: Evidence from the Italian prison experiment. *American Economic Journal: Applied Economics*, 4(2), 199-218.
- Dustmann, C., & Landersø, R. (2021). Child's gender, young fathers' crime, and spillover effects in criminal behavior. *Journal of Political Economy*, 129(12), 3261-3301.
- Johnson, R., & Raphael, S. (2012). How much crime reduction does the marginal prisoner buy?. *The Journal of Law and Economics*, 55(2), 275-310.
- Kessler, D., & Levitt, S. D. (1999). Using sentence enhancements to distinguish between deterrence and incapacitation. *The Journal of Law and Economics*, 42(S1), 343-364.
- Levitt, S. D. (1996). The effect of prison population size on crime rates: Evidence from prison overcrowding litigation. *The quarterly journal of economics*, 111(2), 319-351.
- Marvell, T. B., & Moody, C. E. (1994). Prison population growth and crime reduction. *Journal of Quantitative criminology*, 10(2), 109-140.

Mueller-Smith, M. (2015). The criminal and labor market impacts of incarceration. *Unpublished Working Paper, 18*.

Philippe, A. (2017). Incarcerate one to calm the others? Spillover effects of incarceration among criminal groups.

Rose, E. K., & Shem-Tov, Y. (2021). How does incarceration affect reoffending? Estimating the dose-response function. *Journal of Political Economy, 129*(12), 3302-3356.

Table 1: Descriptive Statistics of Inmates and Crime Partners

	Focal offender	Criminal partners
Number of crime partners	3.091 (3.803)	
Male	0.965 (0.183)	0.882 (0.323)
Age	28.12 (8.141)	26.99 (8.420)
Immigrant	0.163 (0.370)	0.173 (0.378)
Incarcerated for 90-180 days	0.470 (0.499)	0.455 (0.498)
Incarcerated for 181-365 days	0.315 (0.464)	0.313 (0.464)
Incarcerated for 1-2 years	0.150 (0.357)	0.159 (0.365)
Incarcerated for more than 2 years	0.0651 (0.247)	0.0735 (0.261)
Incarcerated for violent crime	0.259 (0.438)	0.274 (0.446)
Incarcerated for property crime	0.506 (0.500)	0.487 (0.500)
Incarcerated for drug crime	0.137 (0.344)	0.132 (0.339)
Incarcerated for other crime	0.0978 (0.297)	0.107 (0.309)
Observations	28946	89467

Note: The table shows descriptive statistics of individuals released from prison between 1996 and 2012 and their criminal partners, defined as individuals with whom they have been convicted for committing a crime with in the 5 years leading up to incarceration. Characteristics are by prison spell observation between 1992 and 2006. Column (1) shows these statistics for all observations and columns (2)-(5) by the crime conviction leading to incarceration. The demographic characteristics in column (1) refers to unique offenders. Standard deviation in parentheses.

Table 2: Similarities between Inmates and their Crime Partners

	(1) Partners	(2) Fake partners
Same gender	0.832 (0.374)	0.819 (0.385)
Age difference	4.663 (5.499)	10.489 (8.283)
Both immigrants	0.810 (0.392)	0.672 (0.469)
Same origin country	0.703 (0.457)	0.517 (0.500)
Same municipality of residence	0.419 (0.493)	0.048 (0.214)
Observations	89467	89467

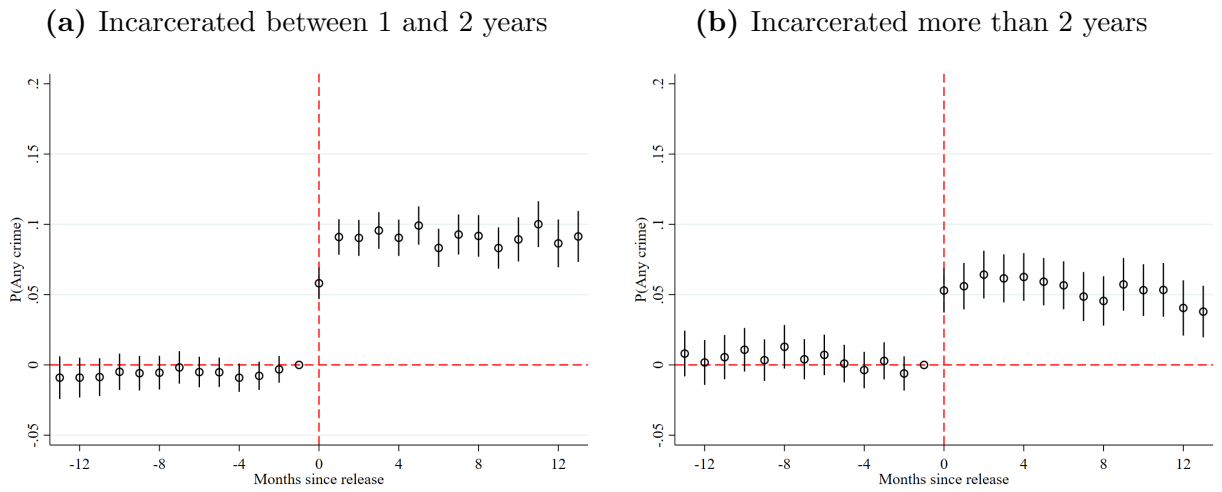
Note: The table shows descriptive statistics of similarities between individuals released from prison between 1996 and 2012 and their criminal partners, defined as individuals with whom they have been convicted for committing a crime with in the 5 years leading up to incarceration in column (1). In column (2) I show similarities that would arise if partners were randomly allocated to inmates. Standard deviation in parentheses.

Table 3: Crime of Newly Released Inmates and their Criminal Partners

	Focal offender	Criminal partners
Charged with a crime committed within 2 years of release	0.784 (0.411)	0.533 (0.499)
Charged with a violent crime committed within 2 years of release	0.347 (0.476)	0.186 (0.389)
Charged with a property crime committed within 2 years of release	0.611 (0.488)	0.360 (0.480)
Charged with a drug crime committed within 2 years of release	0.466 (0.499)	0.269 (0.443)
Convicted for a crime committed within 2 years of release	0.716 (0.451)	0.460 (0.498)
Convicted for a violent crime committed within 2 years of release	0.217 (0.412)	0.113 (0.317)
Convicted for a property crime committed within 2 years of release	0.472 (0.499)	0.255 (0.436)
Convicted for a drug crime committed within 2 years of release	0.295 (0.456)	0.188 (0.391)
Observations	28946	89467

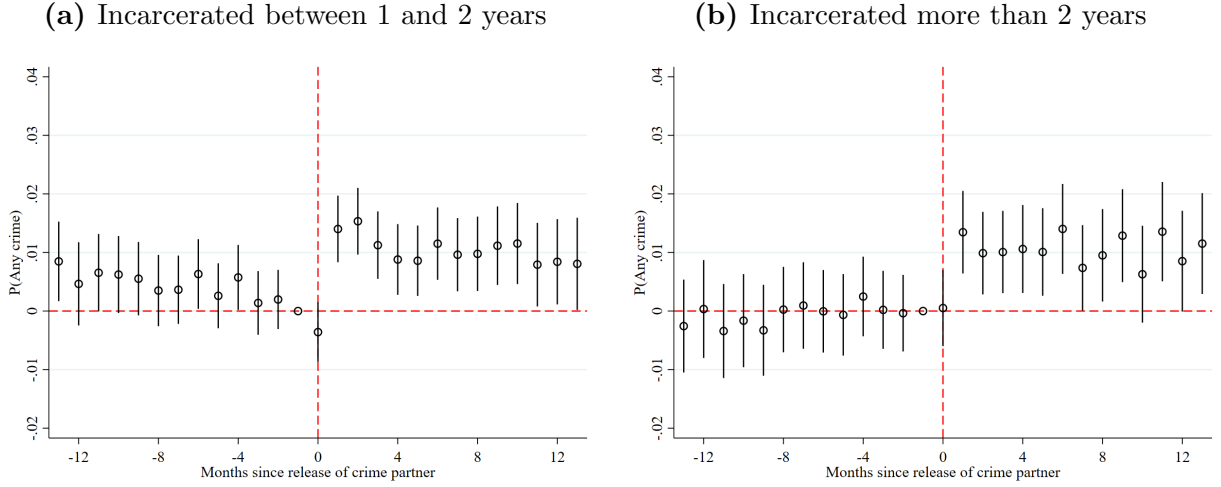
Note: The table shows the share of inmates and their criminal partners who commit crime in the 24 months following the inmates release from prison. Criminal partners are defined as individuals with whom the inmate have been convicted for committing a crime with in the 5 years leading up to incarceration. Standard deviation in parentheses.

Figure 1: Release from Prison and Crime



Note: The figure shows the estimated change (relative to the month prior to release) in the probability that inmates commit at least one crime in a given month for which they are eventually charged in the period surrounding their release from prison at time 0. These are shown separately for inmates serving between 1 and 2 years in prison in Panel (a) and for inmates serving more than 2 years in prison in Panel (b). Vertical lines indicate 95% confidence intervals based on standard errors clustered at the level of the focal offenders.

Figure 2: Release from Prison and Crime of Partners



Note: The figure shows the estimated change (relative to the month prior to release) in the probability that criminal partners of inmates commit at least one crime in a given month for which they are eventually charged in the period surrounding the release of the inmate from prison at time 0. These are shown separately for partners of inmates serving between 1 and 2 years in prison in Panel (a) and for partners of inmates serving more than 2 years in prison in Panel (b). Vertical lines indicate 95% confidence intervals based on standard errors clustered at the level of the focal offenders.

Table 4: Release from Prison and Crime of Partners

	(1) Crime	(2) Violent crime	(3) Property crime	(4) Drug crime	(5) Other crime
Incarcerated 1-2 years: Post	0.011*** (0.001)	0.003*** (0.001)	0.007*** (0.001)	0.004*** (0.001)	0.005*** (0.001)
Incarcerated 2+ years: Post	0.010*** (0.002)	0.003*** (0.001)	0.007*** (0.001)	0.003** (0.001)	0.003*** (0.001)
Observations	898502	898502	898502	898502	898502
Mean of dep. variable	0.064	0.009	0.033	0.019	0.016
Individual fixed effects	X	X	X	X	X
Time fixed effects	X	X	X	X	X

*Note: The table show estimates of the effect of releasing one inmate from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged. Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$*

Table 5: Inmate Type, Release from Prison and Crime of Partners

	(1) Crime	(2) Violent crime	(3) Property crime	(4) Drug crime	(5) Other crime
Violent \times Post	0.010*** (0.002)	0.004*** (0.001)	0.007*** (0.002)	0.003** (0.001)	0.004** (0.001)
Property \times Post	0.015*** (0.002)	0.003*** (0.001)	0.010*** (0.001)	0.005*** (0.001)	0.005*** (0.001)
Drug \times Post	0.004* (0.002)	0.002** (0.001)	0.002 (0.001)	0.002 (0.001)	0.003*** (0.001)
Other \times Post	0.009* (0.004)	0.002 (0.001)	0.009*** (0.003)	0.001 (0.002)	0.002 (0.002)
Observations	898501	898501	898501	898501	898501
Mean of dep. variable	0.064	0.009	0.033	0.019	0.016
Individual fixed effects	X	X	X	X	X
Time fixed effects	X	X	X	X	X

Note: The table show estimates of the effect of releasing one inmate who were incarcerated for the incarcerated type of crime from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged. Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 6: Past Joint Crime, Inmate Release from Prison and Crime of Partners

	(1) Crime	(2) Violent	(3) Property	(4) Drug	(5) Other
Violent \times Post	0.010*** (0.002)	0.004*** (0.001)	0.005*** (0.002)	0.004** (0.001)	0.005*** (0.001)
Property \times Post	0.012*** (0.002)	0.003*** (0.001)	0.008*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
Drug \times Post	0.007*** (0.002)	0.002*** (0.001)	0.005** (0.001)	0.001 (0.001)	0.004*** (0.001)
Other \times Post	0.003 (0.004)	-0.001 (0.002)	0.000 (0.003)	0.001 (0.003)	0.001 (0.003)
Observations	898500	898500	898500	898500	898500
Mean of dep. variable	0.064	0.009	0.033	0.019	0.016
Individual fixed effects	X	X	X	X	X
Time fixed effects	X	X	X	X	X

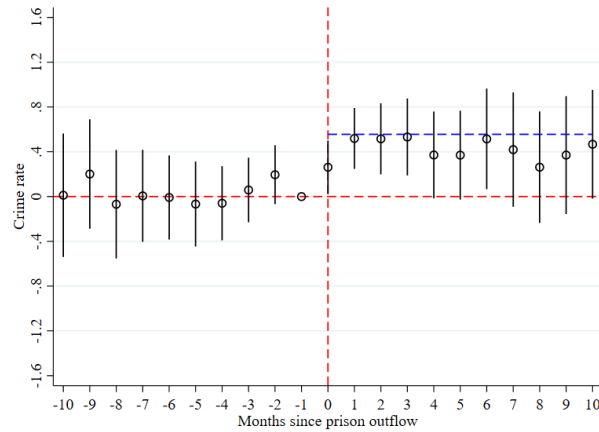
Note: The table show estimates of the effect of releasing one inmate from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged. These effects are estimated separately by the type of crime inmates and crime partners were convicted for in the past. Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 7: Inmate Release, Crime of Partners and Similarity Between Inmates and Partners

	(1)	(2)	(3)	(4)	(5)
Post	0.010*** (0.001)	0.020*** (0.003)	0.021*** (0.005)	0.022*** (0.006)	0.016* (0.007)
Observations	898502	101728	59042	35011	24191
Mean of dep. variable	0.064	0.082	0.083	0.075	0.099
Individual fixed effects	X	X	X	X	X
Time fixed effects	X	X	X	X	X
Same gender		X	X	X	X
Same municipality		X	X	X	X
Age dif < 2		X			
Age dif < 1			X	X	X
Same origin				X	
Immigrant					X

Note: The table show estimates of the effect of releasing one inmate from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged. These effects are estimated separately for groups where the inmates and their partner are more similar. Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Figure 3: Municipality Prison Release Rates and Reported Crimes



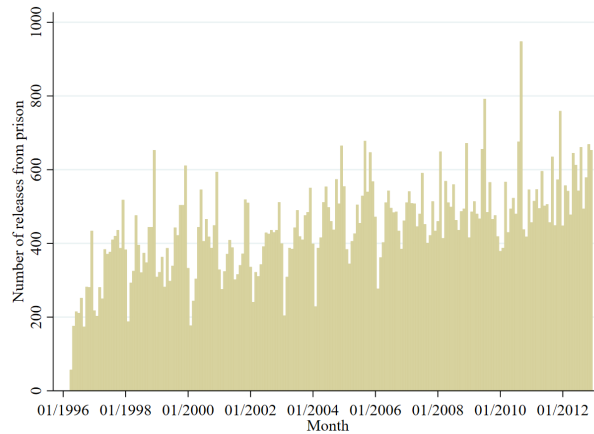
Note: The figure show estimates of the effect of monthly prison outflows of municipality residents, on the municipality specific number of reported crimes in percent of the municipality population size. Event time refers to months since the outflows are measured. I condition on municipality by year fixed effects and time fixed effects. The sample consists of all Danish municipalities observed at a monthly level from 1996 to 2012. Vertical lines indicate 95% confidence intervals calculated from standard errors clustered at the municipality level.

Table 8: Municipality Incarceration and Crime

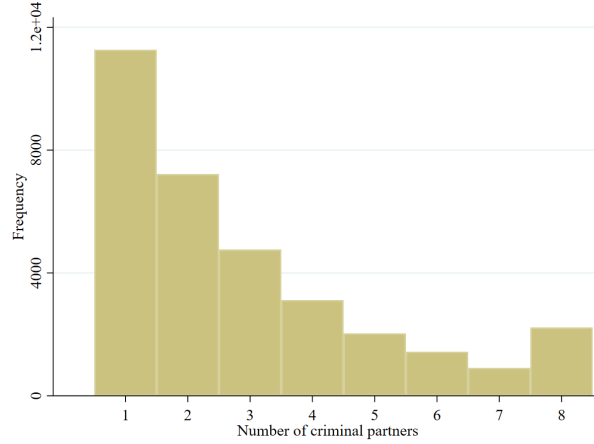
	(1)	(2)	(3)	(4)	(5)
	Crime	Violent crime	Property crime	Drug crime	Other crime
Cumulative prison inflow, lagged	-0.4439*** (0.0852)	-0.0202*** (0.0068)	-0.3595*** (0.0758)	-0.0216*** (0.0076)	-0.0426 (0.0276)
Cumulative prison outflow, lagged	0.5559*** (0.0787)	0.0220*** (0.0070)	0.5206*** (0.0758)	0.0097 (0.0085)	0.0035 (0.0390)
<i>N</i>	45925	45925	45925	45925	45925
Mean of dep. variable	0.0093	0.0002	0.0078	0.0002	0.0010
Municipality by year fixed effects	X	X	X	X	X
Time fixed effects	X	X	X	X	X

Note: The table show estimates of the effect of monthly prison inflows and monthly prison outflows of municipality residents, on the municipality specific number of reported crimes in percent of the municipality population size. We condition on municipality by year fixed effects and time fixed effects. The sample consists of all Danish municipalities observed at a monthly level from 1992 to 2006. Standard errors, reported in parentheses, are clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

A Appendix

Figure A.1: Number of Release Event over Time

Note: The figure shows the number of inmates, spending more than 90 days incarcerated, who are released from prison each month in Denmark between 1996 and 2012.

Figure A.2: Number of Criminal Partners

Note: The figure shows the number of criminal partners of inmates released from prison between 1996 and 2012 defined as individuals with whom they have been convicted for committing a crime with in the 5 years leading up to incarceration. 8 indicates group sizes of 8 or more.

Table A.1: Release from Prison, Crime Charges and Crime Convictions of Partners

	(1) Crime	(2) #Crimes	(3) Conviction	(4) #Convictions
Incarcerated 1-2 years: Post	0.011*** (0.001)	0.037*** (0.005)	0.007*** (0.001)	0.007*** (0.001)
Incarcerated 2+ years: Post	0.010*** (0.002)	0.026*** (0.005)	0.006*** (0.001)	0.007*** (0.001)
Observations	893253	893253	893253	893253
Mean of dep. variable	0.064	0.116	0.033	0.035
Individual fixed effects	X	X	X	X
Time fixed effects	X	X	X	X

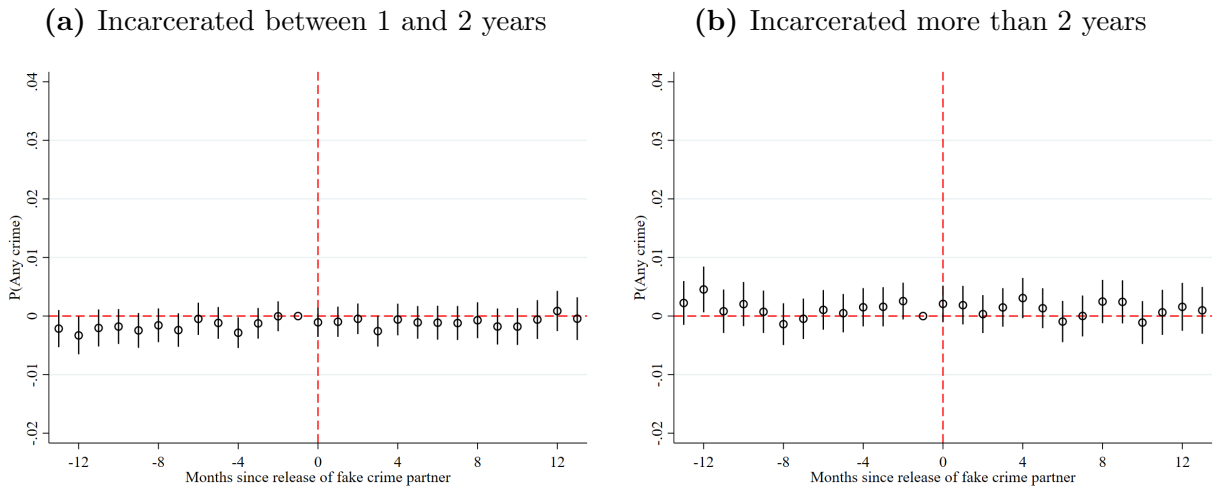
*Note: The table show estimates of the effect of releasing one inmate from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged in column (1), on the number of crimes committed in a month leading to a charge in column (2) on the monthly probability of committing at least one crime leading to a conviction in column (3) and on the number of crimes leading to a conviction in column (4). Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$*

Table A.2: Inmate Release, Crime of Partners and Similarity Between Inmates and Partners

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Same gender	Age dif < 2	Age dif < 1	Age j > i	Same municipality
Post	0.010*** (0.001)	0.011*** (0.001)	0.012*** (0.002)	0.012*** (0.002)	0.009*** (0.002)	0.014*** (0.002)
Observations	898502	731790	322374	185459	419016	278599
Mean of dep. variable	0.064	0.070	0.073	0.073	0.061	0.069
Individual fixed effects	X	X	X	X	X	X
Time fixed effects	X	X	X	X	X	X

Note: The table show estimates of the effect of releasing one inmate from prison on the monthly probability that his/her criminal partners will commit at least one crime for which they are eventually charged. These effects are estimated separately for groups where the inmates and their partner are more similar. Standard errors, reported in parentheses, are clustered at the level of the released offender. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Figure A.3: Release from Prison and Crime of Fake Partners



Note: The figure shows the estimated change (relative to the month prior to release) in the probability that fake criminal partners of inmates commit at least one crime in a given month for which they are eventually charged in the period surrounding the release of the inmate from prison at time 0. These are shown separately for fake partners of inmates serving between 1 and 2 years in prison in Panel (a) and for fake partners of inmates serving more than 2 years in prison in Panel (b). Vertical lines indicate 95% confidence intervals based on standard errors clustered at the level of the focal offenders.