Explaining the Differential Consequences of Imprisonment and a Noncustodial Alternative for Union Formation and Dissolution in Denmark

Peter Fallesen, PhD

Rockwool Foundation Research Unit

Lars H Andersen, MSc

Rockwool Foundation Research Unit

Department of Sociology, University of Copenhagen

Earlier versions presented at SCS in Stockholm, ASC in San Francisco, PAA in San Diego, and at University of Copenhagen. We thank Christopher Wildeman and Signe Hald Andersen for comments. This research received financial support from the Rockwool Foundation.

ABSTRACT

Existing literature on the relationship between imprisonment and union formation and dissolution finds that imprisonment reduces men's chances on the marriage market and increases their divorce risk. Serving a prison sentence at home under electronic monitoring could mitigate the negative effects of imprisonment on union formation and dissolution. This paper studies the effect of electronic monitoring as a noncustodial alternative to imprisonment on Danish male offenders' risk of relationship dissolution and on general singlehood, and analyzes mechanisms through which imprisonment could affect union formation and dissolution. We exploit a penal reform that expanded the use of electronic monitoring in Denmark in 2008 to address nonrandom selection into serving a prison sentence at home under electronic monitoring instead of in prison. Results from N = 2,664 men show that electronic monitoring significantly and persistently lowers the risk of both being single and becoming single during the first four years following conviction. We further show that electronic monitoring lowers this risk because offenders who serve their prison sentence at home under electronic monitoring do not experience the same degree of human capital depletion and the strain of spousal separation as imprisoned offenders do. We find no evidence of a social stigma effect of imprisonment on union formation and dissolution once we control for the stigma of a criminal conviction.

INTRODUCTION

Imprisonment not only impairs the future labor market chances of offenders and contributes to social inequality (e.g., Western, 2006), recent research also emphasizes how imprisonment reduces men's chances on the marriage market (e.g., Svarer 2011) and increases their divorce risk (e.g., Apel et al. 2010; Lopoo and Western 2005; Massoglia, Remster and King 2011; Siennick, Stewart and Staff 2014). Importantly, the negative consequences of imprisonment for romantic relationships correlate both with sentence length (Massoglia, Remster and King 2011) and with the severity of the crime (Apel et al. 2010).

But empirical knowledge on the negative consequences of imprisonment for romantic relationships is still incomplete. We do not know, for example, whether imprisonment directly affects offenders' potential as spouses or whether the negative association between imprisonment and romantic relationships is simply confounded by other characteristics that make offenders less suitable as romantic partners even in the absence of conviction and imprisonment. Also, even though incarceration is not a discrete event and different offenders receive different sentence lengths, we currently do not know whether the negative association between imprisonment and romantic relationships is driven by incarceration as a discrete event (social stigma of incarceration) or by length of incarceration causing spousal separation and human capital depletion.

In this study we address these issues. We do so by providing a strong causal test of the effect of imprisonment relative to electronic monitoring on union formation and dissolution and on singlehood, and by examining these effects across sentence length. We outline and analyze a number of mechanisms through which imprisonment could affect union formation and dissolution, mechanisms which electronic monitoring could help to mitigate. To minimize the

risk of confounding factors and to obtain uncontaminated effect estimates, we rely on data from before and after a policy reform that expanded the use of electronic monitoring as a noncustodial alternative to imprisonment in Denmark in 2008. We use Danish register data on N = 2,664 men who were older than 25 years of age and who were sentenced to imprisonment for up to three months for non-traffic related offences in the period 2006-2009, and link these data with official housing registers to obtain relationship status. These data then contain the entire population of convicted offenders who were targeted by the policy reform in 2008, of whom some were imprisoned and others served their prison sentence at home under electronic monitoring.

Previous research has studied how alternatives to imprisonment affect, for example, criminal recidivism (Di Tella and Schargrodsky 2013; Gendreau et al. 2000; Green and Winik 2010; Spohn and Holleran 2002), labor market attachment (Andersen 2014; Andersen and Andersen 2014), and children's foster care placements (Andersen and Wildeman 2014). Our study is the first to isolate the effect of a noncustodial alternative to imprisonment, such as electronic monitoring, on relationship dissolution and on singlehood. We use a policy reform as a natural experiment to address the issue that offenders are not randomly assigned to electronic monitoring. We find that electronic monitoring significantly and substantially decreases the risk of relationship dissolution and singlehood during at least the first four years following conviction. For the entire sample, electronic monitoring decreases the risk of being single by 12 percentage points four years after the conviction, compared to imprisonment. For men who are in a relationship when they are convicted, electronic monitoring decreases the risk of being single with 21 percentage points, also after four years. Examining the effect across sentence length and across offender types shows that men with longer sentences are the primary drivers of the findings. This result suggests that separation from society and from the romantic partner (for

those who were in a romantic relationship upon conviction) and human capital depletion are the predominant mechanisms through which imprisonment affects relationship dissolution and singlehood. It is not surprising that these mechanisms drive the results, because electronic monitoring allows offenders to serve their prison sentence while maintaining their human capital and keeping close connection to significant others.

Our study contributes to the literature on imprisonment, life courses, and family formation in four ways. First, we provide estimates of the effect of a noncustodial alternative to imprisonment on family formation using a quasi-experimental research setup. Second, we use the same quasi-experimental setup to analyze two different consequences of imprisonment on family formation, by examining how imprisonment affects the risks of relationship dissolution and singlehood separately. Third, we show that the higher singlehood and relationship dissolution risks among imprisoned men are caused by the duration of separation from society and from the romantic partner (for those who were in a relationship upon imprisonment), and not by imprisonment in itself. Fourth, from a policy perspective we show that one of the promising tools for accelerating decarceration trends, home confinement under electronic monitoring, has positive externalities beyond simply being cheaper than imprisonment—both for offenders and their families.

PARTNERSHIP, INCARCERATION, AND DIVORCE

Research has linked imprisonment to increased divorce risks (Apel et al. 2010), just as research has shown that it is harder for men who are marked by a criminal record (and who have been imprisoned) than for non-convicted men to find a spouse and marry (van Schellen, Poortman and Nieuwbeerta 2011; Svarer 2011; see, however, King, Massoglia and MacMillan 2007). But it

remains empirically unanswered what drives these negative associations between imprisonment and romantic relationships. Many processes associated with imprisonment could lead to poorer marriage market opportunities and elevated risks of relationship dissolution and singlehood following release.

In this section we argue that three general mechanisms are central to understanding the relationship between imprisonment, singlehood, and divorce: The social stigma of imprisonment; the depletion of human capital during imprisonment; and the separation from significant others during imprisonment. After discussing each of the three mechanisms, we discuss electronic monitoring as a noncustodial alternative to imprisonment and relate this to the outlined mechanisms.

Social Stigma

One sociological explanation of the link between imprisonment and romantic relationships is that criminal conviction and imprisonment place severe social stigma on offenders (e.g., Braman 2004; Pager 2003, 2009). Social stigma is a process by which people infer unobserved negative traits about a person from one observed characteristic or life event, such as imprisonment (Goffman, 1963). Being imprisoned in this way, correctly or incorrectly, signifies that the imprisoned person has a bad personality, which could matter for his or her chances on the marriage market as well as for his or her divorce risk.

Imprisonment has also been shown to place social stigma on people who are in a romantic relationship with someone who is imprisoned (e.g., Comfort 2008). In much the same way as when a criminal offender faces social stigma, a spouse's imprisonment signifies unobserved negative traits about the non-imprisoned spouse, and staying in the relationship could very well

create strain from spillovers of stigma from the offender to the non-imprisoned spouse—which could lead to an increased divorce risk.

Human Capital Depletion

Imprisonment depletes human capital by introducing spells of non-employment and a loss of acquired skills during imprisonment (Western, Kling and Weiman 2001). Recent empirical research, which uses empirical setups similar to what we use in this study, compares labor market outcomes among imprisoned people and people who experience noncustodial alternatives to imprisonment, such as community service (Andersen 2014) or electronic monitoring (Andersen and Andersen 2014). Results from these studies show that imprisonment causes worse labor market outcomes following release than noncustodial alternatives do.

Imprisonment in this way impairs a person's life chances and might very well make that person a less valuable match on the marriage market, which not only complicates single men's search for a partner (Becker 1973), but also increases the relationship dissolution risk among offenders who are in romantic relationships or who are married (Becker, Michael and Landes 1977). In addition, offenders gain criminal capital during imprisonment through interactions with imprisoned peers, which is likely to be negatively correlated with human capital that is sought for by employers (Bayer, Hjalmarsson and Pozen 2009). This could also make them less attractive spouses. And, indeed, studies have shown that criminal recidivism is lower among electronically monitored offenders than among imprisoned offenders (e.g., Di Tella and Schargrodsky 2013; Marklund and Holmberg 2009).

Separation

In addition to social stigma and human capital depletion, which impairs the future life chances of all imprisoned people, imprisonment places an additional burden on people who have a romantic partner in the community, as their imprisonment also implies the physical separation of the spouses. Such separation may lead to estrangement of the spouses (Massoglia, Remster and King 2011) and to elevated household strain due to a decrease in the offender's financial and emotional support to their partner and the household during imprisonment (Apel et al. 2010; Wildeman, Schnittker and Turney 2012). In addition, recent research finds that women report decreased relationship quality during the years after a partner's incarceration (Turney 2015).

The physical separation of spouses during imprisonment is likely to matter for divorce risks. Massoglia, Remster and King (2011) identify three ways in which the effect might play out. First, physical separation could lower relationship satisfaction (Turney 2015), for example by decreasing emotional interactions between the spouses (Booth et al. 1984) and by reducing available social support (Turney, Schnittker and Wildeman 2012). Second, with one adult missing in the household, the non-incarcerated spouse faces a much larger household workload and becomes the sole provider for a time (e.g., Wildeman, Schnittker and Turney 2012). Third, people change, and due to the lack of day-to-day interactions between spouses, they may have a hard time reconciling old impressions with new ones following imprisonment, simply because they have not had the opportunity to experience these changes gradually (e.g., Rindfuss and Stephen 1990).

Summary of Theoretical Effects

The three general mechanisms that we have just outlined jointly describe the total effect of imprisonment on men's risk of being and becoming single after a criminal conviction. Thus, we

can decompose the total effect of imprisonment on romantic relationships into the following set of theoretical effects:

$$TOTAL\ EFFECT = \rho_1 STIGMA + \rho_2 CAPITAL\ DEPLETION + \rho_3 SEPARATION \qquad (1)$$

In Equation 1, ρ_1 measures the weight in the total effect of imprisonment on romantic relationships given to the stigma of imprisonment relative to electronic monitoring. This weight is unaffected by sentence length, and pertains to imprisonment or electronic monitoring as discrete event. ρ_2 captures the weight given to human capital depletion during imprisonment relative to electronic monitoring, which increases with sentence length. ρ_3 measures the weight in the total effect given to the intimacy loss and relationship strain experienced by offenders and their spouses because of separation during imprisonment, which also increases with sentence length. Importantly, this last weight (ρ_3) is zero for those who were not in a relationship upon conviction, as intimacy loss and relationship strain only pertains to offenders who were in a relationship upon conviction.

As we show in the Method and Data section below, we can use the theoretical decomposition presented in Equation 1 to guide an empirical investigation of which mechanism carries more weight in the connection between imprisonment and the risk of singlehood. But first, we describe the noncustodial alternative to imprisonment which our study focuses on, electronic monitoring, and how this way of serving a prison sentence could change the risks of singlehood and relationship dissolution among convicted offenders.

Electronic Monitoring: The Danish Case

Electronic monitoring in Denmark is a way of serving a prison sentence. When offenders in Denmark are sentenced to imprisonment they, provided that their personal circumstances and their criminal case adheres to formal preconditions, are offered to apply for serving their prison sentence at home under intensive surveillance. Some offenders apply for and are granted permission to serve their prison sentence at home under electronic monitoring. Others either do not apply, are not permitted to do so, refuse to accept the conditions of electronic monitoring, or have their permission revoked because of technical violations.

Electronic monitoring implies that the offender is fitted with a GPS tracking device (anklet) and has to adhere to a strict time schedule. For example, even short deviations from the time schedule, such as coming home from work ten minutes late, will set off an alarm at the Danish Prison and Probation Service, who administers the electronic monitoring. The Prison and Probation Service then contacts the offender and demands an explanation of the delay. As a last resort, the Danish Prison and Probation Service can revoke the electronic monitoring permission and transfer the offender to imprisonment. In addition to sticking to the strict organization of everyday life, the offender serving a prison sentence under electronic monitoring has to accept additional conditions. Finally, electronically monitored offenders are required to participate in a crime prevention program (Danish Corrections Act, Law no. 367).

Eligibility to serve a prison sentence at home under electronic monitoring is not only obtained from accepting the conditions of electronic monitoring. Offenders must have a permanent address (e.g., not be living in a shelter for the homeless) and either be employed, participate in some form of active labor market program, or be enrolled in education. Unemployed offenders can fulfill this employment criterion by working at institutions appointed

by the Prison and Probation Service. In addition, if the offender has cohabiting family members, then these members must formally accept the electronic monitoring of the offender in the home. Last, only offenders who have not previously committed any serious crime—defined as a crime punishable by more than a fine—within 2 years prior to the conviction are eligible for serving a prison sentence at home under electronic monitoring (Danish Corrections Act, Law no. 367).

The electronic monitoring scheme in Denmark has been gradually expanded since it was first introduced in May 2005. First, traffic offenders could serve prison sentences shorter than 3 months in their own homes under electronic monitoring. In April 2006, the scheme was extended to include all offenders younger than 25 years of age, regardless of the offense type (still with a maximum sentence length of 3 months). In June 2008, the policy reform that we exploit in our analyses removed the age requirement. Offenders of all ages and regardless of offense type could now apply for electronic monitoring, provided that their prison sentence did not exceed 3 months.[1] Last, in 2010 and 2013 the maximum sentence length requirement of 3 months was expanded to 5 and 6 months, respectively, and the reform also abandoned the requirement of no serious crimes within 2 years prior to the conviction.

Figure 1 shows the sharp increase in the share of men targeted by the 2008 reform, which we use in our analyses, who completed their prison sentence at home under electronic monitoring. We use this reform in our analyses because it targets older offenders, of whom a comparatively large share is in a relationship upon conviction.[2] The men in the figure are all older than 25 years of age, they are convicted of non-traffic offenses, and they received a prison sentence that was shorter than 3 months.[3] From the figure it is seen that before the 2008 reform all these men served their prison sentence in prison, while the same is only true for around 60 percent after the reform.

[Insert Figure 1 about here]

The maximum sentence length requirement of 3 months (today: 6 months) could seem to aim electronic monitoring at a very small group of offenders who receive such short prison sentences. But sentences in Denmark are generally that short, and around two thirds of all prison sentences in Denmark are shorter than 3 months (Danish Prison and Probation Service, 2013). Thus, electronic monitoring is a noncustodial alternative to the majority of prison sentences in Denmark, and results in this study concerns a non-negligible share of offenders in Denmark.

Electronic Monitoring and Romantic Relationships

Electronic monitoring in Denmark restricts the offender in his or her daily movements and his social life outside the home, while at the same time requiring him or her to hold down employment or education and remain (physically) present in the family home while serving the prison sentence. The design and implementation of electronic monitoring in Denmark could ameliorate the negative consequences of imprisonment on romantic relationships.

For people who are not in a relationship, the main difference between imprisonment and electronic monitoring pertains to whether or not the social stigma of imprisonment exceeds the social stigma of serving a prison sentence at home under electronic monitoring, and whether or not human capital suffers more from imprisonment than from electronic monitoring. Empirical evidence that distinguishes between these two mechanisms is rare. But even though qualitative studies have found that wearing a visible GPS tracker produces public shame (Martin, Hanrahan and Bowers 2009; Payne and Gainey, 1998), existing studies argue that other people are likely to view imprisonment as more indicative of a bad personality (e.g., Western et al. 2001). Also, serving a prison sentence at home under electronic monitoring reduces the offender's absence

from society, making it easier for the offender to keep or at least search for a job (Payne and Gainey 2004). Thus, compared to single offenders who are imprisoned, single offenders who serve a prison sentence at home under electronic monitoring are likely to have better chances on the marriage market, because they are targeted by fewer social stigmas and because their human capital suffers less during their sentence.

For people who are in a relationship, a partner's incarceration can, because of the theoretical mechanisms that we outlined above, lead to changes in the costs and rewards of being in that particular relationship, and make alternative partners comparatively more appealing (Siennick, Stewart and Staff 2014). The normative social repercussions of leaving a spouse could also be much lower if the spouse is imprisoned, and staying in the relationship might even, as mentioned, create strain from spillovers of stigma from the offender to the spouse (e.g., Comfort 2008). Thus, if the non-incarcerated spouse uses information about the new life situation to update his or her beliefs about the relationship's feasibility compared to outside options, imprisonment could lead to a higher risk of relationship dissolution. When the imprisonment stretches for longer periods it could even provide the non-imprisoned spouse with more time for the strain of a changed life situation to permeate everyday life, leading to even higher divorce risks.

Qualitative research stresses that during electronic monitoring the offender's family members are essentially serving the sentence along with the offender, and have to cope with the offender's frustrations over his or her own lack of autonomy (Payne, 2014; Payne and Gainey, 1998). Yet the spouse of an offender serving a prison sentence at home under electronic monitoring may still rely on his or her partner to participate in housework, supply additional household income, and be emotionally and physically available. And the spouse does not face

strain derived from having an incarcerated (i.e., absent) partner, just as electronic monitoring does not place the non-imprisoned spouse in a situation where he or she can easily imagine his or her life without the (absent) spouse. Thus, we expect that couples are less likely to grow apart if it is possible for them to remain together in the home and community during the prison sentence.

In conclusion, there are three main reasons why we expect electronic monitoring to affect romantic relationship outcomes following a criminal conviction and sentence. First, electronic monitoring could reduce the risk of relationship dissolution through separation, as spouses are not physically separated during electronic monitoring (they might even spend more time together because electronic monitoring forbids the offender to leave the house outside specified hours and except for with specified purposes, such as going to work). Second, electronic monitoring, at least in Denmark, could help to avoid human capital depletion, as being employed either in a job, in a job training program, or in education, as mentioned, is a requirement for electronic monitoring in Denmark. Third, electronic monitoring removes the social stigma of imprisonment.

METHOD AND DATA

In this study, we compare singlehood rates and relationship dissolution rates across offenders (a) who have all committed similar crimes; (b) who were all convicted for these crimes; and (c) who were all sentenced to similar prison sentences for these crimes—some of these offenders just served their prison sentence at home under electronic monitoring rather than in prison. Thus, we compare two offender groups who on average differ only in that one group experiences imprisonment whereas the other group serves their prison sentence at home under electronic

monitoring, and any difference between their outcomes are attributable to the difference between their imprisonment or electronic monitoring experience.

Instrumental Variables Approach

The sharp increase in the use of electronic monitoring for offenders older than 25 years of age around the reform in 2008 provides us with a plausibly exogenous shock that allows us to test the effects on singlehood and relationship dissolution of serving a prison sentence at home under electronic monitoring rather than in prison. As already discussed, individual and unobserved offender traits are strongly correlated with who apply for, are granted permission to, and eventually complete their sentence under electronic monitoring in Denmark. The selection has two causes: (a) it is offenders themselves who apply for (and accept) electronic monitoring; and (b) the Danish Prison and Probation Service actively prioritizes between offenders. Thus, electronic monitoring is endogenous to offender traits.

But whether or not an offender was convicted before or after the 2008 reform represents a change in all offenders' probability of serving their prison sentence at home under electronic monitoring, which is plausibly uncorrelated with offender traits. To enhance our claim that the 2008 reform represents a change that is uncorrelated with offender traits—a situation typically referred to as a natural experiment—recall that electronic monitoring in Denmark is not a sentence passed by a judge, it is a way of serving a prison sentence. Thus, eligibility to use electronic monitoring is determined not by a judge but by the Prison and Probation Service after the judge has sentenced the offender to imprisonment.

Viewing the 2008 reform as a natural experiment allows us to estimate the effect of electronic monitoring on singlehood and partnership dissolution within an instrumental variables

(IV) approach. Equations 2 and 3 show the IV model in our setup, suppressing subscripts and letting τ and ϵ represent random errors:

$$EM = \boldsymbol{X\varphi} + \gamma POLICY + \tau \quad (2)$$

$$P[SINGLE = 1] = \boldsymbol{X\beta} + \delta\widehat{EM} + \epsilon \quad (3)$$

Equation 2 is the first stage equation, which regresses the binary indicator of whether an offender was convicted after the 2008 reform (*POLICY*) on serving a prison sentence at home under electronic monitoring (which is the endogenous variable, *EM*), controlling for observable offender characteristics (***X***). The first stage equation provides the predicted probability of serving a prison sentence at home under electronic monitoring that is uncorrelated with offender traits. This happens because, as we have argued, the 2008 reform provides a change in the probability of serving a prison sentence at home under electronic monitoring that is exogenous to offender traits.[4] Equation 3, which is the second stage equation, then regresses relationship status on the predicted probability of serving under electronic monitoring, which is exogenous to offenders traits because of the first stage equation. We also control for observable offender characteristics. This model then provides a consistent and plausibly causal estimate of the effect of serving a prison sentence at home under electronic monitoring on singlehood (see Bollen 2012 for a review on the use of instrumental variables in Sociology).

We estimate two IV models to measure the effect of serving a prison sentence at home under electronic monitoring on relationship outcomes. First, we estimate one IV model using all men in our sample, both those who were in a relationship and those who were single when they were convicted, to estimate the effect of electronic monitoring on singlehood. This model provides a causal estimate of the effect of serving a prison sentence at home under electronic monitoring on becoming single (for men who were in a relationship upon conviction) and on staying single (for men who were single upon conviction) simultaneously. Second, because we,

as discussed, expect electronic monitoring to be especially beneficial to offenders who were in a relationship upon conviction (because these offenders do not suffer from spousal separation during imprisonment), we estimate another IV model using only men who were in a relationship upon conviction. This model provides a causal estimate of the effect on relationship dissolution and not just singlehood.

Distinguishing between Mechanisms

Results from our first two IV models provide estimates on the difference in relationship outcomes among imprisoned offenders and offenders who serve their prison sentence at home under electronic monitoring. But as previously discussed, we can decompose the overall effect into three separate effects, driven by social stigma, human capital depletion, and spousal separation (see Equation 1).

Decomposing the total effect allows us to analyze which of the effects is more predominant in our sample. By assuming constant effect sizes across relationship status and using a parsimonious measure of sentence length (splitting the sample by the median incarceration length of 40 days), we run the IV models for those with short sentences (shorter than 40 days) and those with longer sentences (longer than 40 days). Significant effects for short sentences indicate substantial weight being given to stigma effects in the total effect of electronic monitoring on relationship outcomes. An increase in the effect size for longer sentences indicates significant weight being given to capital depletion and separation effects. By further comparing these results between men who were in a relationship upon conviction and men who were single, and still conditioning on sentence length, we can parse out the separation effect from the capital

depletion effect, since the separation effect, by definition, is zero for singles—they have no spouse to be separated from.

The strategy for decomposing the total effect of electronic monitoring does not provide us with a formal test of the relative weight of stigma effects, human capital depletion effects, and separation effects. But comparing results across the models we have just mentioned provides a feeling for just how important each of these theoretical effects are for the total effect of electronic monitoring on relationship outcomes.[5]

Data, Sample, and Variables

We use full population register data available from Statistics Denmark. In Denmark, all citizens receive a unique personal identification number when they are born (or, for immigrants, when they obtain citizenship), and this number identifies the person in various administrative regards throughout his or her life. Statistics Denmark collects these data, which cover wide arrays such as tax forms, education, housing, marital status, and criminal justice contacts, from administrative agencies, and makes them available for research purposes. The personal identification numbers allow researchers to merge individual information from the various registers, and Danish register data then essentially constitute an individual level panel of all Danish citizens and a wide range of their communications with administrative agencies (for a discussion of the merits of these register data, see Lyngstad and Skardhamar 2011).

From the register data we use a sample of 2,664 men who were older than 25 years of age when they were sentenced to imprisonment for less than three months for a non-traffic offense in the period 2006-2009. Although additional requirements, such as being employed and having a permanent address, as mentioned, had to be met to ensure eligibility for serving a prison sentence

at home under electronic monitoring, the sample of 2,664 men corresponds to the raw sample targeted by the reform in 2008. We merge this sample with information from the Danish Prison and Probation Service on who served their prison sentence at home under electronic monitoring and who served their sentence in prison.

As the dependent variable, we define singlehood as being unmarried and not cohabiting with a partner for each of the four years following conviction. Research from other countries, such as the United States, tends to view marriage and cohabitation as distinct family formation events (e.g., Nock 1995; Sassler 2004), but in Denmark, as well as in other Nordic countries, there is compelling reasons for viewing cohabitation and marriage as a unified category (see Heuveline and Timberlake 2004). Thus, we do not analyze the effect of electronic monitoring on divorce; we analyze the effect of electronic monitoring on being single or dissolving a romantic relationship. We measure relationship status at the beginning of each calendar year.

To distinguish between the effect of electronic monitoring on singlehood and on relationship dissolution, we, as mentioned, run the analyses both using the full sample and using only the subsample of men who were in a relationship upon conviction. We refer to these samples as the Full Sample (2,664 men) and the Relationship Sample (847 men). As control variables we add age, years of education, offense type (theft, violence, or other offenses), and ethnic minority background. These control variables are all measured at the time of the conviction.

FINDINGS

Descriptive Results

Table 1 shows descriptive statistics of the Full Sample and the Relationship Sample. The table shows that 21.4 % of the Full Sample served their prison sentence at home under electronic monitoring, and all electronic monitoring occurred after the reform. Men who completed their sentence under electronic monitoring were significantly younger, more educated, more likely to be convicted of violent crimes, but less likely to be convicted of the residual offense category "Other crime" (which mainly consists of drugs offenses and public disorder) than the group of imprisoned men. In the Relationship Sample, 24.3 % completed their sentence at home under electronic monitoring, and again, all electronic monitoring occurred following the reform. Regarding control variables, there are no statistically significant differences between those who served their sentence at home under electronic monitoring and those who were imprisoned.

[Insert Table 1 about here]

Additional calculations show that among those who were permitted to serve their sentence at home under electronic monitoring, 9% in both samples failed to abide by the requirements, and had their permission revoked. We include these men in the group of electronically monitored offenders, even though they were transferred to imprisonment to serve what remained of their sentence. Thus, we use a conservative definition of serving a prison sentence at home under electronic monitoring, and our effect estimates should in this light be viewed as lower bound estimates.

Figure 2(a) shows the singlehood rates for the men in our Full Sample, conditional upon whether they were imprisoned or served their sentence at home under electronic monitoring. As seen from the figure, electronically monitored men have lower singlehood rates from five years before their conviction and up to 5 years following the conviction. This descriptive result indicates that there are substantial differences in relationship behavior between the two groups

even long before conviction, and electronic monitoring is, as already discussed, endogenous to offender traits. But even though both groups follow not too dissimilar trajectories during the years before conviction, the share of electronically monitored men who were single decreased following conviction, whereas the share of singles among imprisoned men increased slightly. Thus, naïve comparisons of singlehood rates for incarcerated men and men who served their sentence under electronic monitoring would lend support to the hypothesis that electronic monitoring decreases singlehood rates, but would also be biased from the selection of specific types of men into electronic monitoring.

[Insert Fig. 2 about here]

Figure 2(b) shows the singlehood rates for men in the Relationship Sample, which is the sample of men who were in a relationship upon conviction. Incarcerated and electronically monitored men in this sample had much more similar singlehood rates during the years before their conviction. Importantly, the two groups' singlehood rates following conviction (i.e., their relationship dissolution rates because they were all in a relationship upon conviction) gaps, and the electronically monitored group had lower risks of being single during the years following conviction. Some of the imprisoned offenders would, however, never be considered eligible for electronic monitoring, and if these offenders also have higher relationship dissolution risks following release, the descriptive result in Figure 3 could be driven by selection issues. Thus, naïve comparisons between the two groups' risk of relationship dissolution would support the hypothesis that electronically monitoring decreases relationship dissolution rates, but could be biased by selection issues.

Instrumental Variables Results

Table 2 shows results from the IV model's first stage equation (Equation 2), which regresses electronic monitoring on the reform dummy and on offender covariates, by sample. Results show that in both samples the 2008 reform had a substantial impact on the chance for serving a prison sentence at home under electronic monitoring rather than in prison. The reform increased the likelihood of serving a sentence under electronic monitoring by 41 (Full Sample) and 47 (Relationship Sample) percentage points, both significant at the .001 level. The statistical relevance of the 2008 reform as an instrumental variable is high, with F-values of 899.63 and 356.86, both far exceeding the Staiger-Stock rule-of-thumb F-value of 10 (Staiger and Stock 1997).

[Insert Table 2 about here]

Table 3 shows results from the IV model's second stage equation (Equation 3), which regresses the predicted probability of serving a prison sentence at home under electronic monitoring that, because it is obtained from the first stage equation, is uncorrelated with offender traits on the risk of singlehood for each of the four years following conviction. Columns 2 to 5 report results from the Full Sample, and show that serving a sentence at home under electronic monitoring leads to a substantially lower risk of being single. For example, the singlehood risk of electronically monitored offenders during the fourth year following conviction is 12 percentage points lower than for those who were imprisoned, which corresponds to an almost 20 percent decrease in the risk of singlehood from the Full Sample average of 69 %. Thus, electronic monitoring lowers the risk of singlehood persistently, significantly, and substantially for at least four years following conviction—a result that is causal in nature.

[Insert Table 3 about here.]

Columns 6 to 9 in Table 3 report the results from the IV model on the Relationship Sample. Results show that when we take selection issues into account, there are substantial and persistent negative effects on relationship dissolution of serving a sentence under electronic monitoring rather than in prison. Four years after the conviction, offenders who served their sentence under electronic monitoring were 21 percentage points less likely to have lost their partner and be single than if they had been imprisoned.[6]

Mechanisms

To decompose the total effect of electronic monitoring and provide a feeling for the weight given to stigma effects, capital depletion effects, and separation effects we, as discussed, compare results across models run on subsamples split by sentence length. Offenders in our sample serve up to 3 months, and we split the sample by the median sentence length of 40 days. We show results by sentence length both from IV models for the Full Sample, the Relationship Sample, and for a subsample of men who were single upon conviction (i.e., those in the Full Sample who are not in the Relationship Sample).

Table 4 reports the results. In the Full Sample we find persistent and negative effects of electronic monitoring on singlehood for offenders with long sentences. Four years after conviction, an offender has 15 percentage points lower risk of being single if he served his sentence at home under electronic monitoring. For the short sentences we see smaller and statistically insignificant estimates. In the Relationship Sample we see a similar pattern: There are persistent and negative effects of electronic monitoring on partnership dissolution risks for those with long sentences, with a dramatic 27.5 percentage points decrease in dissolution risk four years after the conviction. Again, estimates for shorter sentences are smaller and statistically

insignificant. We only find significant results for the effect of electronic monitoring on singlehood and relationship dissolution rates for longer sentences.

[Insert Table 4 about here.]

Testing the coefficient for electronic monitoring from the short sentences sample against the coefficient from the long sentences sample reveals that they are statistically different from each other at the five percent level during the first year following conviction. But for the following years the differences are statistically insignificant, likely because of the small sample sizes. Still, effect sizes differ greatly by sentence length.

In the sample of offenders who were single upon conviction, we find no significant effects of electronic monitoring on remaining single when we split the sample by sentence length. The estimate for electronic monitoring during the first year after conviction for those serving longer sentences is, however, significant at the 10 percent level.

Comparing results across the models in Table 4 to decompose the total effect of electronic monitoring and provide a feeling for the weight given to stigma effects, capital depletion effects, and separation effects shows only weak evidence of a stigma effect of incarceration (note that all men in our samples are convicted offenders sentenced to imprisonment, so we have already implicitly controlled away the stigma of criminal conviction and sentencing). But we do find strong support for separation effects and slight support for a short term human capital depletion effect. Serving a prison sentence at home under electronic monitoring rather than in prison ameliorates the negative impact of sentence length on offenders' marriage market opportunities, especially among those who are in a relationship when they are convicted.

DISCUSSION

In this study we estimated the effect of imprisonment relative to electronic monitoring on romantic relationship dissolution and on singlehood. Results consistently showed that offenders who serve a prison sentence at home under electronic monitoring have lower singlehood and relationship dissolution rates for at least four years following conviction. In fact, results showed that offenders who serve their prison sentence under electronic monitoring have dramatically better relationship outcomes than comparable offenders who are imprisoned: electronically monitored men have a 12 percentage points lower singlehood rate four years following conviction, which, although a large effect, dwarfs the 21 percentage points reduction in singlehood rates four years following conviction among electronically monitored offenders who were in a relationship upon conviction.

In Denmark, where the just mentioned effects are found, it is generally not random which offenders are permitted to serve their prison sentence at home under electronic monitoring. When an offender has been sentenced to imprisonment for a maximum of three months (today: six months), which is the maximum sentence length in almost two-thirds of sentences in Denmark, eligibility to serve the sentence at home under electronic monitoring is evaluated by the Danish Prison and Probation Service, based on formal as well as informal criteria (e.g., offender traits). Thus, electronic monitoring is endogenous to offender traits, and comparing relationship outcomes among offenders who are imprisoned and offenders who serve their prison sentence at home under electronic monitoring will generally yield biased results. But the effects we have just mentioned come from an instrumental variables approach, in which we exploited a policy reform in 2008 which expanded the use of electronic monitoring for offenders who were older than 25 years of age and who were sentenced to imprisonment for less than 3 months for non-traffic offenses. Using the 2008 reform as a natural experiment, which allowed us to obtain variation in

electronic monitoring that was uncorrelated with offender traits, provided us with unbiased estimates of the effect of electronic monitoring on relationship outcomes. The large effect sizes that we just reported come from this instrumental variables approach, and are thus uncontaminated estimates of the effects of electronic monitoring.

Previous research has stressed the importance of considering duration when studying the impact of incarceration on offenders' divorce and singlehood rates (Massoglia, Remster and King 2011; Siennick, Stewart and Staff 2014). We have extended this line of inquiry in three important ways. First, we have shown that duration of incarceration indeed has a causal effect on singlehood and relationship dissolution by using a quasi-experimental design. Second, we have distinguished between plausible mechanisms linking incarceration to relationship dissolution and singlehood, showing that there are little evidence of a stigma effect of incarceration once implicitly controlling for the stigma of criminal conviction and sentencing. Third, we have shown that the effects are pronounced even for offenders who only serve comparatively short sentences. None of the offenders in our sample were sentenced to imprisonment for more than 3 months, but despite these comparatively short sentences we still found substantial effects.

One of the most popular contemporary criminological theories, the Informal Social Control Theory (Laub and Sampson 2009; Sampson and Laub 1993, 2005), emphasizes the engagement with prosocial social institutions, such as marriage, as important for the criminal desistance process. Today, most criminologists and sociologists seem to credit this idea (see, however, Gottfredson and Hirschi 1993), and results from our analyses are good news to these scholars. Not only are our results good news because lower singlehood rates imply additional offenders in romantic relationships, which should produce lower recidivism rates according to the theory, but results from our more elaborate analyses further emphasized the social tie component of

romantic relationships as the predominant, though not exclusive, carrier of the effect. In these more elaborate analyses we decomposed the total effect of electronic monitoring into its three theoretical components—stigma effects, human capital depletion effects, and spousal separation effects. Empirically, we provided a feeling for the relative weight of these theoretical effects by comparing results across sentence length and across subsamples. For imprisonment relative to electronic monitoring we found little evidence of stigma effects over and above the stigma of conviction and sentencing (i.e., we found no evidence of a stigma of incarceration), but we found important human capital depletion effects and even more pronounced effects of spousal separation during imprisonment.

For policy makers, our results are good news too. In general, policies do not translate well across countries, and simply copying the use of electronic monitoring in Denmark to another context, like to the United States, is probably infeasible. The United States has comparatively high probation and parole rates, which places great workloads on probation and parole officers, and putting more people under community supervision (such as on electronic monitoring) would probably require a noteworthy increase in funding to the community corrections field (DeMichele, 2014). But results from Denmark could inspire policy makers in other countries to be attentive to some of the positive aspects of the way electronic monitoring is implemented in Denmark (e.g., Payne, 2014). Electronic monitoring in Denmark is, just like any other correctional measure, a tool which is applied in certain ways by certain people in certain contexts (DeMichele, 2014). Handpicking from the way this correctional tool is used in Denmark, and in other contexts, could help to assemble electronic monitoring in, for example, the United States in a way that could improve on offender outcomes relative to imprisonment.

Existing research has shown that, compared to imprisonment, electronic monitoring decreases criminal recidivism (e.g., Di Tella and Schargrodsky 2013) and strengthens the labor market outcomes of offenders (e.g., Andersen and Andersen 2014). Also, at least in Denmark, electronic monitoring is cheaper to run than imprisonment (Andersen and Andersen 2014), which implies additional positive externalities. Now that we also know that electronic monitoring decreases singlehood rates, electronic monitoring seems like an even more viable way to accelerate current decarceration trends—especially among offenders who have prosocial assets available to them in the form of marriage or a cohabitating partner.

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Danish Corrections Act, Law no. 367: Fuldbyrdelse af straf på bopælen under intensiv overvågning og kontrol samt begrænset fællesskab for "negativt stærke" indsatte m.v [The execution of sentences as home confinement under intensive monitoring and control, and decreased community privileges for "negatively strong" prisoners, etc.]. Enacted on May 24, 2005.

NOTES

[1] The reform in 2008 prohibited the use of electronic monitoring for offenders convicted on charges of possession of weapons or explosives who were sentenced to a prison term lasting less than 2 weeks.

[2] We do not exploit the other reforms for inference in this study, as these other reforms either targeted offender groups with very low relationship shares, or the reforms were enacted so recently that we do not have sufficient data to perform the required analyses.

[3] Also, the men in the sample did not receive prison sentences shorter than 2 weeks for violating the law on possessing weapons or explosives, nor had they been punished by more than a fine during the previous 2 years, corresponding to the requirements of the reform.

[4] To be a feasible instrument it is further required that the reform does not affect the general singlehood propensity in the population of Danish men. Examining the general trend in singlehood rates shows no abrupt changes in singlehood propensities across the reform period for Danish men aged 18 to 45 (results available upon request).

[5] Our strategy for decomposing the effects rests on the assumption that the reform affects offenders identically across sentence length. To provide empirical evidence that this is indeed the case, we, using the samples that we describe in the next section, have (a) regressed sentence length on the predicted probability of serving a prison sentence at home under electronic monitoring; and we have (b) run the first stage regressions separately for offenders with short and long sentences. Results from these regressions, which are reported in Table A1 in the appendix, show that (a) there are no notable differences in the probability of serving under electronic monitoring, by sentence length, when we control for selection into electronic monitoring, just as (b) the reform instrument estimate is similar in the two subsamples. We have

also analyzed whether (c) sentence length is predictive of serving a sentence under electronic monitoring rather than in prison, and (d) whether sentence length is predictive of being convicted after the reform. Results, which are reported in Table A2 in the appendix, lend little support to any correlation between (c) sentence length and way of serving the sentence; just as they show that (d) the reform did not change sentence lengths. Thus, we find no empirical evidence that the mechanisms sketched out should be infeasible.

[6] The results we have just presented show that there are substantial negative effects of serving a prison sentence at home under electronic monitoring on singlehood and on relationship dissolution. But because the Full Sample includes all offenders in the Relationship Sample, in which we found very strong effects of electronic monitoring, it could be the case that results from the Full Sample are simply driven exclusively by men in the Relationship Sample. To test whether this is the case, we estimate separate models for men who were single upon conviction. Results (not shown but available on request) show borderline significant negative effects for the first year and then insignificant but negative estimates for the remaining years. Thus, the effect of electronic monitoring on singlehood is primarily, though not exclusively, driven by strong effects for men who are in a relationship upon conviction.

Table 1 Descriptive statistics of the Full Sample and the subsample of men in relationship at year of conviction (Relationship Sample)

	Full Sample			Relationship Sample		
	Full	EM =0	EM=1	Full	EM=0	EM=1
Single	0.685	0.698	0.650*			
	(0.464)	(0.459)	(0.480)			
Reform=1	0.522	0.392	1.000	0.523	0.370	1.000
	(0.500)	(0.488)	(0.000)	(0.500)	(0.483)	(0.000)
Electronic monitoring	0.214			0.243		
	(0.410)			(0.429)		
Age	38.877	39.212	37.645***	39.139	39.364	38.436
	(9.373)	(9.543)	(8.619)	(9.625)	(9.915)	(8.645)
Education in years	10.815	10.738	11.095***	11.133	11.040	11.421
	(2.412)	(2.409)	(2.407)	(2.540)	(2.536)	(2.538)
Theft	0.086	0.087	0.079	0.059	0.056	0.068
	(0.280)	(0.282)	(0.270)	(0.236)	(0.230)	(0.252)
Violence	0.594	0.573	0.674***	0.643	0.637	0.665
	(0.491)	(0.495)	(0.469)	(0.479)	(0.481)	(0.473)
Other crime	0.320	0.340	0.247***	0.298	0.307	0.267
	(0.467)	(0.474)	(0.432)	(0.457)	(0.462)	(0.443)
Minority	0.166	0.169	0.158	0.196	0.207	0.160
	(0.372)	(0.374)	(0.365)	(0.397)	(0.406)	(0.368)
N	2664	2094	570	847	641	206

Note: We test the H_0: $E(X|EM = 0) = E(X|EM = 1)$ for all covariates X.
* p < .05; ** p < .01; *** p < .001.

Table 2 First stage estimates of the reform instrument and covariates on the probability of serving a prison sentence at home under electronic monitoring.

	Full Sample	Relationship Sample
Reform=1	0.410***	0.466***
	(0.014)	(0.025)
Age	0.071*	0.132*
	(0.033)	(0.061)
Age^2	-0.002*	-0.003*
	(0.001)	(0.001)
Age^3	0.000*	0.000
	(0.000)	(0.000)
Education	0.011***	0.014**
	(0.003)	(0.005)
Theft	-0.001	0.033
	(0.027)	(0.056)
Violence	0.071***	0.033
	(0.015)	(0.028)
Minority	-0.016	-0.042
	(0.018)	(0.031)
Constant	-1.110*	-2.067*
	(0.457)	(0.851)
R^2	.27	.31
F-value for instrument	899.63	356.86
N	2664	847

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3 IV estimates of the effect of electronic monitoring on singlehood, by year following conviction, for Full Sample and Relationship Sample

	Full Sample				Relationship Sample			
	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
EM	-0.083	-0.095*	-0.112*	-0.121**	-0.070	-0.161*	-0.162*	-0.206**
	(0.044)	(0.043)	(0.044)	(0.044)	(0.063)	(0.068)	(0.070)	(0.072)
Age	-0.011	-0.064	0.023	0.028	-0.008	-0.142	-0.045	-0.097
	(0.043)	(0.044)	(0.044)	(0.044)	(0.069)	(0.077)	(0.078)	(0.080)
Age^2	-0.000	0.002	-0.000	-0.000	0.000	0.003	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Age^3	-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)	(0.000)	(0.000)
Education	-0.012**	-0.011**	-0.014***	-0.015***	-0.002	-0.001	-0.009	-0.011
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.007)	(0.007)
Theft	0.081*	0.043	0.043	0.016	0.039	0.092	0.084	0.062
	(0.032)	(0.033)	(0.033)	(0.034)	(0.063)	(0.071)	(0.077)	(0.074)
Violence	0.008	-0.018	-0.040*	-0.018	0.123***	0.090**	0.018	0.061
	(0.020)	(0.020)	(0.020)	(0.020)	(0.031)	(0.035)	(0.037)	(0.037)
Minority	-0.041	-0.030	-0.027	-0.0403	-0.058	-0.027	-0.038	-0.026
	(0.025)	(0.025)	(0.025)	(0.025)	(0.036)	(0.039)	(0.041)	(0.042)
Constant	0.557	1.653**	0.366	0.281	0.343	2.410*	1.077	1.798
	(0.601)	(0.604)	(0.609)	(0.608)	(0.974)	(1.081)	(1.101)	(1.126)
1^{st} stage F-value	899.63***	899.63***	899.63***	899.63***	356.86***	356.86***	356.86***	356.86***
N	2664	2664	2664	2664	847	847	847	847

Note: "Other crimes" is the reference category for type of crime. Standard errors are in parentheses.
* $p < .05$; ** $p < .01$; *** $p < .001$

Table 4 IV estimates of the effect of electronic monitoring on singlehood in the Full Sample, Relationship Sample, and a sample of men who were single upon conviction, by sentence length and by year following conviction

	Year 1	Year 2	Year 3	Year 4	*N*
Full Sample					
40 days or less	-0.065	-0.109	-0.093	-0.111	1472
	(0.058)	(0.058)	(0.058)	(0.059)	
More than 40 days	-0.131*	-0.097	-0.149*	-0.149*	1192
	(0.064)	(0.064)	(0.065)	(0.064)	
Relationship Sample					
40 days or less	0.045	-0.093	-0.088	-0.145	457
	(0.076)	(0.084)	(0.086)	(0.088)	
More than 40 days	-0.223*	-0.249*	-0.265*	-0.275*	390
	(0.106)	(0.113)	(0.116)	(0.118)	
Not in Relationship Sample					
40 days or less	-0.051	-0.046	-0.036	-0.029	1015
	(0.051)	(0.059)	(0.062)	(0.067)	
More than 40 days	-0.103	-0.028	-0.097	-0.079	802
	(0.054)	(0.061)	(0.067)	(0.068)	

Note: Control variables are Age, Age^2, Age^3, Education, Ethnic minority, and Type of crime. Standard errors are in parentheses.
* $p < .05$; ** $p < .01$; *** $p < .001$

Fig. 1 Share completing their prison sentence at home under electronic monitoring among men targeted by the reform in June 2008 (men older than 25 years of age; non-traffic offenses; prison sentences shorter than 3 months).

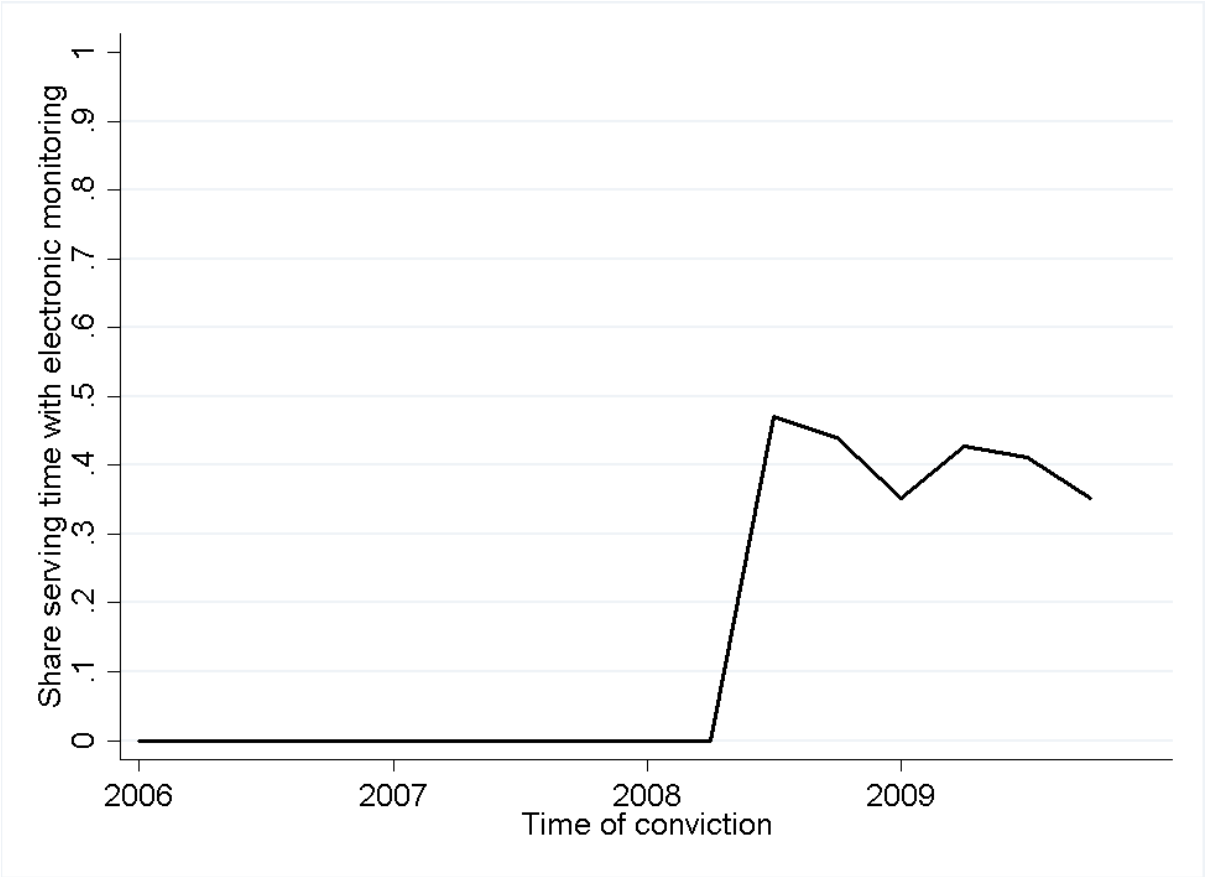
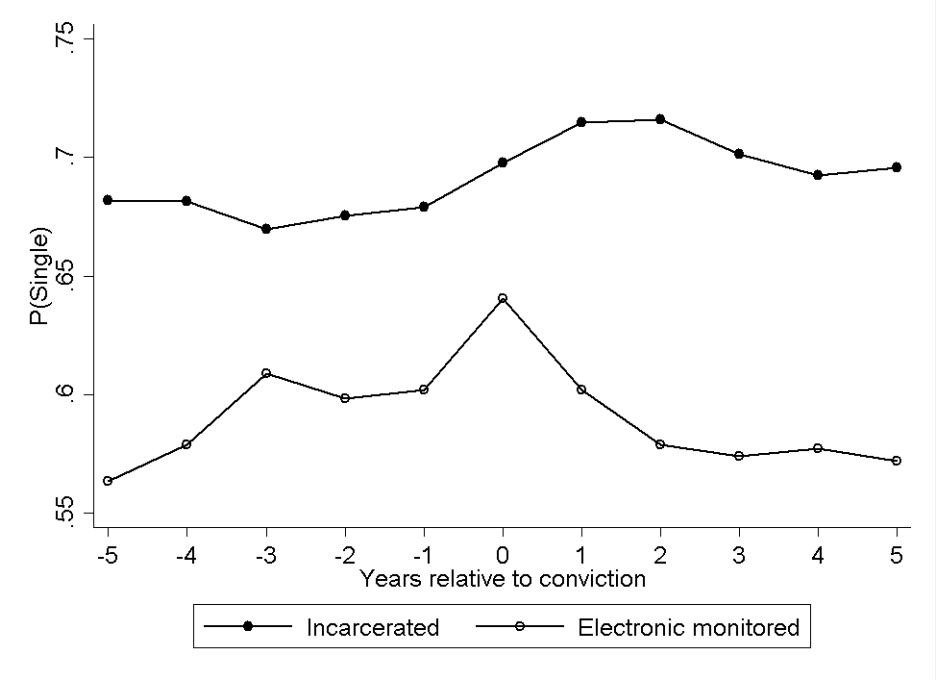
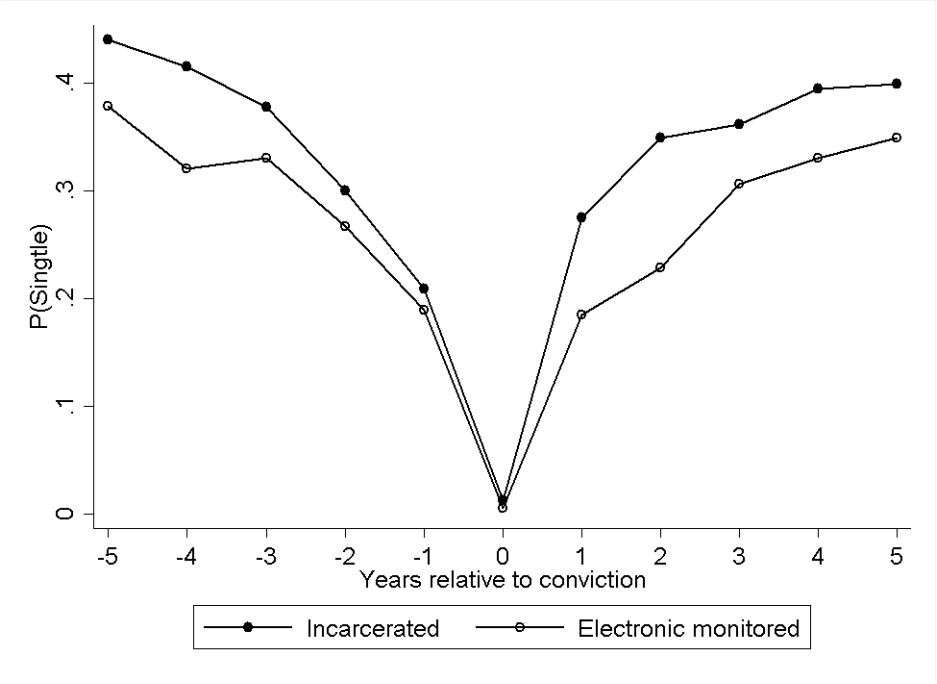


Fig. 2 Singlehood rates for incarcerated men and men serving a prison sentence at home under electronic monitoring



(a) Full sample



(b) Relationship sample

APPENDIX

Table A1 Testing whether the instrument has constant impact across sentence length

	Full Sample		Relationship Sample	
	40 days or less	> 40 days	40 days or less	> 40 days
Policy=1	0.414***	0.414***	0.506***	0.429***
	(0.018)	(0.021)	(0.034)	(0.036)
N	1472	1192	457	390

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

Table A2 Treatment indicator and instrument dummy regressed on sentence length and covariates for Full Sample and Relationship Sample

	Full Sample		Relationship Sample	
Outcome:	EM	Reform-dummy	EM	Reform-dummy
Sentence length	-0.000	-0.000	-0.000	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Age	0.043	-0.067	0.126	-0.013
	(0.038)	(0.047)	(0.072)	(0.085)
Age^2	-0.001	0.001	-0.003	0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Age^3	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.011**	-0.000	0.012*	-0.005
	(0.003)	(0.004)	(0.006)	(0.007)
Theft	0.024	0.064	0.057	0.051
	(0.031)	(0.038)	(0.067)	(0.079)
Violence	0.070***	0.001	0.028	0.012
	(0.018)	(0.022)	(0.033)	(0.039)
Minority	-0.020	-0.012	-0.068	-0.052
	(0.021)	(0.026)	(0.037)	(0.044)
Constant	-0.491	1.523*	-1.704	0.773
	(0.528)	(0.647)	(1.016)	(1.190)
R^2	.016	.004	.017	.004
N	2664	2664	847	847

Note: "Other crime" is the reference category for type of crime. Standard errors are in parentheses.

* $p < .05$; ** $p < .01$; *** $p < .001$