Can Electronic Monitoring Reduce Reoffending?

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Abstract

We evaluate electronic monitoring as an alternative to prison for non-violent offenses. Leveraging plausibly exogenous variation in sentencing outcomes generated by quasi-random assignment of judges, we find electronic monitoring reduces reoffending at both extensive and intensive margins. Compared with prison, electronic monitoring is estimated to reduce the probability of reoffending by 22 percentage points 5 years after sentencing and by 11 percentage points 10 years after sentencing, with the cumulative number of offenses reduced by 45 percent 10 years after sentencing. These results demonstrate that electronic monitoring can have sustained crime-reducing effects.

Keywords: electronic monitoring; prison; reoffending; crime

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1 Introduction

Imprisonment rates have increased in many OECD countries since the 1980s, particularly in the United States, western Europe, and Australia (Bhuller et al., 2020). In the US, the incarceration rate tripled between 1980 and 2010, while in Australia, the imprisonment rate rose by 260 percent between 1982 and 2018 (Australian Bureau of Statistics, 2019; Australian Institute of Criminology, 1983). The high cost associated with growing prison populations, estimated to be on the order of 80 billion dollars in the US (DeVuono-Powell et al., 2015), has led to substantial interest in sentencing alternatives to incarceration. One alternative that has attracted significant attention is electronic monitoring. Electronic monitoring (EM) typically involves offenders serving their sentence in their homes, with their location tracked using an electronic monitoring ankle bracelet. As such, it provides a low-cost means of depriving offenders of their liberty. However, there are concerns that allowing offenders to serve their sentence at home rather than in prison is likely to be perceived as a “soft” or lesser punishment, and may therefore be less effective at deterring reoffending.\(^1\) We study whether this is the case, providing new evidence on the impact on reoffending of serving a sentence under EM rather than in prison.

Electronic monitoring is not new. As of 2017, more than 30 countries had adopted it in one form or another (Bartels & Martinovic, 2017). Its use in the UK dates back almost 30 years (Hucklesby & Holdsworth, 2016). In recent times, however, its popularity has

\(^1\)We focus on specific deterrence, although general deterrence may also be of concern. While we are unable to address this issue, in their recent review of the literature, Chalfin & McCary (2017) conclude that “within the range of typical changes to sanctions in contemporary criminal-justice systems, the evidence suggests that the magnitude of deterrence owing to more severe sentencing is not large” (page 32), and that “the current elasticity of crime with respect to prison populations is approximately 0.2” (page 26).
grown considerably in Europe, Australia, parts of South America, and the US (Di Tella & Schargrodsky, 2013; Henneguelle et al., 2016; Mendonca & Pignataro, 2018; Nellis, 2014; Richardson, 1999; The Pew Charitable Trusts, 2016). Despite its increasing use, few studies provide convincing evidence as to whether EM reduces recidivism relative to imprisonment (Renzema & Mayo-Wilson, 2005). This is because those who receive a sentence of EM are likely to differ from those who receive a sentence in prison in observable ways, such as in the seriousness of the offense, and in unobservable ways, such as in the extent of their remorse, that may make them less likely to reoffend. As a consequence, the causal effect on reoffending of serving a sentence under EM rather than in prison is difficult to identify.

A second difficulty in evaluating the impact of EM on recidivism is that it is not a single, well-defined form of intervention applied at a particular stage in the criminal justice process to a defined set of offenders (DeMichele, 2014). Electronic monitoring has been used as an alternative to pre-trial detention, as an alternative to a custodial sentence served in prison, as a condition of bail, as a requirement of community and suspended sentence orders, and as a form of early release. In some jurisdictions it can be used for any type of offense, including violent offenses, whereas other jurisdictions limit its use to non-violent and less serious offenses. In this paper, we study the use of EM as a front-end alternative to a custodial sentence served in prison for non-violent offenders, and we consider its impact on

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2In the UK, the use of electronic monitoring grew from 83 offenders in its first year of operation to between 12,300 and 14,000 offenders at any one time by 2016–17 (Richardson, 1999). In France, electronic monitoring expanded from 143 offenders at the end of its pilot phase to approximately 10,000 offenders at any one time in 2016 (Henneguelle et al., 2016). In the US, the number of accused and convicted criminal offenders subject to electronic monitoring is estimated to have risen nearly 140 per cent over the 10-year period ending in 2015 (The Pew Charitable Trusts, 2016). The use of electronic monitoring has also grown in Sweden and the Netherlands (Nellis, 2014), and parts of South America (Di Tella & Schargrodsky, 2013; Mendonca & Pignataro, 2018).
both the extensive and intensive margins of reoffending.

In order to evaluate the impact of serving a sentence under EM on reoffending we draw on detailed individual-level linked administrative data from courts, prisons, and corrective services for a large urban population. An instrumental variables strategy is employed to address selection into EM. Our approach exploits plausibly exogenous variation in sentencing outcomes generated by quasi-random assignment of cases to judges who differ in their tendency to use the sentencing options of EM and prison.\(^3\) The local average treatment effect that we identify is the impact of serving a sentence under EM for offenders who would have served their sentence in prison had they faced a judge less inclined to its use. Our estimates show that, for this group, serving a sentence under EM reduces reoffending by 22 percentage points 5 years after sentencing, by 15 percentage points 7 years after sentencing, and by 11 percentage points 10 years after sentencing. We also find that serving a sentence under EM substantially and significantly reduces reoffending at the intensive margin, as measured by the cumulative number of new offenses committed. For example, 10 years after sentencing, the total number of new offenses committed per offender is estimated to be reduced by 5. This represents a 45 percent reduction in the intensity of offending compared to those who served a prison sentence.

Ours is not the first study to evaluate the impact of EM on reoffending relative to prison. Di Tella & Schargrodsky (2013) examine the impact of pre-trial EM in Argentina; Henneguelle et al. (2016) evaluate a pilot of EM as a front-end alternative to prison in France; Marie (2009) examines the impact of EM on reoffending in the context of early

\(^3\)This approach is similar to that used by others to study the impact of incarceration (Aizer & Doyle, 2015; Bhuller et al., 2020; Dobbie et al., 2018; Green & Winik, 2010), length of incarceration (Kling, 2006), and pre-trial EM (Di Tella & Schargrodsky, 2013).
release for offenders serving prison sentences in England and Wales; and Jørgensen (2011) studies the use of EM for young offenders with short sentences of up to 3 months in Denmark. These studies are unanimous in finding that EM reduces reoffending.

In context of this nascent literature, our contributions are threefold. First, we provide evidence that a well established EM program that diverts offenders from prison, and that operates at a large number of sites, reduces reoffending. Previous research has studied the use of EM at the pre-trial phase, where bail might otherwise be used, and for early release from prison, where parole might be considered as an alternative (Di Tella & Schargrodsky, 2013; Marie, 2009). Studying the use of EM as a front-end alternative to prison is important because, used in this way, it diverts offenders from prison and thereby serves as a genuine alternative to incarceration. Further, the EM program we study is well established. This is important, as positive findings from pilots are not always replicated when programs are scaled up (Henneguelle et al., 2016).

Our second contribution is that we provide the first evidence on the impact of a serving a sentence under EM out to a 10 year horizon. Previous studies typically consider reoffending within two years, with the the longest reported time horizon reported being five years. Our results establish substantial reductions in reoffending at much longer durations than previously documented, suggesting that the diversionary and rehabilitative aspects of the EM program we study led to long-term changes in offender behavior.

Our final contribution is to demonstrate that, in addition to reducing reoffending at the extensive margin, the EM program we evaluate reduces reoffending at the intensive margin. Ours is the first study to show that serving a sentence under EM significantly and substantially reduces the cumulative number of subsequent charges before the courts,
and this reduction endures 10 years after the finalization of the index court case. The combination of a reduction in both the likelihood of reoffending and the number of charges over an extended time period provides important evidence on the potential for EM to reduce the economic burden of crime.

The remainder of this paper is set out as follows. Section 2 provides background on the EM program we study, and the courts and sentencing environment in which it is available as an alternative to prison. Section 3 presents our conceptual framework and empirical strategy. Section 4 discusses the data and provides a descriptive analysis of the relationship between EM, prison, and reoffending. Section 5 investigates the validity of the identifying assumptions we employ. Section 6 provides our baseline analysis and a sensitivity analysis. We conclude in Section 7.

2 Background

2.1 Electronic Monitoring in NSW

Electronic monitoring has been available in Sydney, the capital of New South Wales (NSW) and Australia’s most populous city, since 1997. It was introduced as a sentencing alternative to prison for less serious, non-violent offenders. It provides a means of depriving offenders of their liberty to a degree similar to a minimum-security prison, while allowing them to maintain family ties, to work, and to access support and treatment services. The aims of the EM program we study are to divert less serious and non-violent offenders from prison while maintaining a high level of supervision, and to reduce the risk of future reoffending through
rehabilitation (Auditor-General’s Report, 2010).

Electronic monitoring involves offenders serving their sentence in the community rather than in prison, but with restricted freedom of movement. Under EM, offenders live at home, either alone or with others (including their family), and are not permitted to leave their home except when approval is given by their supervising Community Corrections Officer for activities such as employment, education, intervention programs, and medical appointments. All activities are scheduled on a weekly basis, and compliance with the schedule and other requirements is monitored via an anklet worn by the offender, and through telephone calls and regular home and field visits (for out of home activities) from their supervising Community Corrections Officer (Studerus, 1997). Offenders must also abstain from using alcohol and illicit drugs and are subject to random testing to ensure compliance.

In addition to diverting less serious offenders from the prison system, EM in NSW also aims to reduce reoffending through rehabilitation. The aim of rehabilitation is pursued by designing offender-specific programs to be undertaken while under EM. For example, offenders may be expected to be employed or to undertake vocational training courses and job search. For those who are not able to work, developmental activities are typically encouraged (Studerus, 1997). In addition, offenders are required to undertake counseling or other programs to address personal issues, often drug-or alcohol-related. Rehabilitation programs are also available to offenders serving a prison term of greater than 6 months; however, undertaking these programs is optional in prison. Further, offenders serving sentences under EM are supported in their rehabilitation by a high rate of face-to-face contact with their supervising officer, who in turn liaises closely with supporting community agencies.
2.2 Sentencing in NSW

In the NSW court system, the sentencing of guilty offenders is a two-step process. The judge must first decide whether a custodial sentence is required and, if so, the duration of the custodial term. If a custodial sentence of no more than 18 months is deemed appropriate, the second step is for the judge to decide the manner in which the sentence should be served. For non-violent offenses with a custodial sentence of no more than 18 months, EM is available as an alternative to prison. In the event that the judge considers an EM sentence appropriate, the offender is referred for assessment of suitability. A Community Corrections Officer prepares a report on the offender and, if it is favorable, the judge may order the sentence to be served under EM.

In preparing their report, the Community Corrections Officer must first ensure that the offender is eligible. Eligibility is based on three criteria: the sentence length is no more than 18 months; the offenses for which EM is being considered are not related to violent or threatening behavior; and the offender’s criminal history does not include violent or threatening offenses. For eligible offenders, assessments consider the impact of EM on family and/or co-residents as well as the offender. If the assessment concludes that the offender poses no substantial threat to their family or other members of the community and can be managed successfully under the terms of EM, and if the offender and all co-residents consent, the offender is recommended as suitable (Studerus, 1997).

While electronic monitoring has been available in NSW since 1997, in the second half of 2007 EM program to the newly established Community Compliance and Monitoring Group (CCMG).\footnote{This occurred following a state election in which the returned Labor government com-}
assumption that “everyone is unsuitable and must prove themselves to be suitable” (Auditor-General’s Report, 2010). Drug and alcohol testing was incorporated into the assessment process, with a positive test leading to a negative assessment. The approach of the CCMG was not well received by judges. The combination of the more stringent assessment process and the fall from favor among the judiciary led EM to all but disappear as a sentencing option. For this reason, this study focuses on the period 2000 – 2007.

2.3 Assignment of Cases to Judges

When offenders are charged with a crime in NSW, their case is heard in the court in the jurisdiction where the crime occurred. In urban locations, such as Sydney, courts are typically multi-court complexes, with each court comprising several courtrooms and a different judge presiding in each courtroom. The Chief Magistrate decides the court at which each judge is headquartered, with assignments lasting for three years in the metropolitan area. Of importance to this study is the way that cases are allocated to judges. Responsibility for allocating cases to courtrooms falls to the coordinating judge in each court complex. He or she prepares a weekly roster to inform judges of which courts they will be sitting in that week. The coordinating judge allocates cases so as to share the workload as evenly as possible, but daily allocations at multi-court complexes are not published until the previous day. Judges are therefore rotated across courtrooms within a court complex on a weekly or daily basis, and across court complexes in the metropolitan area every three years. There is no scope mitted to reducing recidivism through greater community monitoring, including through the use of EM of post-release, high-risk offenders. As a consequence, all offenders on EM were viewed by the CCMG as high risk despite the majority of offenders who received EM as a front-end alternative to prison being low risk as measured by the Level of Service Inventory –Revised scale.
for defendants to influence the choice of judge and no scope for judges to pick and choose cases. These features mean that within the pool of available judges, the assignment of judge to case within a court complex is effectively random.

It is the random assignment of judge to case combined with differences between judges in their tendency to refer offenders for assessment for EM that our instrumental variables strategy is based upon. Judges’ tendencies are measured using judge – specific leave – out mean rates of referral for assessment for EM. The leave – out mean is calculated using all other randomly assigned cases that the judge has handled for which EM is available, comprising cases before and after the index cases.

While we cannot directly test the assumption that among the pool of available judges in a court complex, judges (and therefore tendencies for EM) are randomly assigned to cases, we can investigate the implication that judge tendency to refer to EM should be uncorrelated with observable characteristics of offenders and their case, conditional on the court and year interacted fixed effects. Court by year fixed effects account for the pool of available judges at a court location potentially changing from year to year due to rotations of judges across courts. Table 1 shows that, while receiving a sentence of EM is correlated with characteristics of the offender and case conditional on interacted court and year fixed effects, judge tendency to refer cases for EM assessment is not. This is consistent with random assignment of cases to judges (and therefore tendency for refer for EM).
3 Research Design

3.1 Conceptual Framework

The primary reason for the use of prison over non-custodial alternatives for non-violent offenders is its perceived greater potential for specific deterrence. The idea behind specific deterrence is that the cost of the criminal justice sanction imposed is sufficient to deter the offender from future offending. In the case of imprisonment, the direct cost of punishment to the offender is loss of freedom and autonomy and costs associated with being removed from the community, including job loss and impacts on family. EM seeks to restrict freedom to a degree similar to a minimum-security prison with day release, but keeps offenders living within the community. Because serving a sentence in prison exerts a greater specific deterrent effect than serving it under EM, a prison sentence should theoretically lead to a greater reduction in reoffending.

That being said, empirical evidence on the deterrent effect of prison on reoffending is limited and mixed.\(^5\) For example, Aizer & Doyle (2015) find that incarceration as a juvenile increases the likelihood of incarceration as an adult, while Hjalmarsson (2009) finds that a custodial sentence reduces the recidivism rate of juvenile offenders. In terms of adult offending, Mueller-Smith (2015) finds that incarceration increases recidivism; Green & Winik (2010) find that it has no effect on recidivism; and in the context of Norway, Bhuller et al. (2020) find that it reduces reoffending.

\(^5\)In their recent and comprehensive review of the literature from economics and criminology, Chalfin & McCary (2017) conclude that the deterrent effect of incarceration is likely small.
fending is that, despite its potential deterrent effect, imprisonment may increase reoffending through other channels. For example, serving a sentence in prison provides opportunities to build criminal networks and accumulate criminal human capital (Bayer et al., 2009), and is likely to reduce attachment to work and family (Apel et al., 2010; Dobbie et al., 2018; Lopoo & Western, 2005; Mueller-Smith, 2015). Both an increase in criminal capital and networks and a reduced attachment to work and family may be expected to increase reoffending behavior. As discussed in Bhuller et al. (2020), the extent to which this occurs can depend on prison conditions and the extent to which the prison system focuses on rehabilitation and preparing inmates for life after prison.

In contrast to a prison sentence, serving a sentence under EM often involves living with family, seeking or undertaking employment and complying with conditions that the correctional authorities deem essential to the offender’s rehabilitation. Correctional authorities make every effort to ensure continued contact with those people most likely to exert a positive influence on the offender’s behavior and cessation of contact with anyone who may exert a negative influence, such as criminal peers. Correctional authorities arrange referrals to a network of service providers who can provide drug and alcohol treatment, mental health treatment, trade training, employment, and housing, all of which are important in addressing the underlying causes of offending behavior. These efforts to effect the offender’s rehabilitation occur against a backdrop of intense surveillance that makes non-compliance with the release conditions readily detectable and easy to respond to. Efforts are made to rehabilitate offenders while in prison but those efforts are inevitably compromised by loss of contact with family, a growth in criminal capital, and a depreciation in labor market skills. Collectively, therefore, the conditions imposed on those serving an EM sentence may
be more likely to reduce the risk of further offending than those imposed on an otherwise similar individual placed in prison. Ultimately, however, the question of whether prison or EM is more effective in reducing reoffending is an empirical one, the answer to which this paper seeks to provide.

3.2 Empirical Framework

Following Bhuller et al. (2020), the empirical set-up that we use to evaluate the impact of serving a sentence under EM rather than in prison is based on the linear probability model:

\[ y_{i,t} = \beta_t E_{i,0} + \theta_t' X_i + \nu_{i,t} \]  

(1)

where \( y_{i,t} \) is the outcome of interest (either an indicator for any reoffending, or the cumulative number of new offenses) for individual \( i \) measured \( t \) periods after their court case is finalized, \( E_{i,0} \) is an indicator equal to one if the offender serves their sentence under EM (where the time period is normalized to be zero at the date of court case finalization), \( X_i \) is a vector of court by year fixed effects and case and offender level control variables, and \( \nu_{i,t} \) is the error term.\(^6\)

The parameter of interest, \( \beta_t \), measures the causal effect of serving a sentence under EM rather than in prison \( t \) periods after sentencing. There are two main challenges in estimating this causal effect. First, the manner in which the offender’s sentence is to be served is

\(^6\)Whether an eligible offender serves their sentence under EM or in prison is also likely to be determined by characteristics such as employment, marital status, and the presence of children. Unfortunately, information on these characteristics is not available.
not randomly assigned; offenders who serve an EM sentence are likely to differ from those who serve their sentence in prison in unobserved ways that are negatively correlated with reoffending, such as in the extent of their remorse or the presence of extenuating circumstance contributing to their behavior. If this is the case, OLS estimates will be biased towards finding that serving a sentence under EM lowers the rate of reoffending.

The second challenge in identifying causal effects is that, in order for a judge to sentence an offender to EM, Community Corrections must provide a favorable assessment. Around 70% of those referred for assessment serve a sentence under EM over the period we examine. This suggests a potential for the assessment process to contribute to a selection effect through positive recommendations to the case judge, and therefore in those that the judge is observed to sentence to EM.

We address these issues of endogenous selection into punishment type using a Two Stage Least Squares (2SLS) approach where the instrumental variable is the tendency of a quasi-randomly assigned judge to refer eligible cases for assessment for EM. This approach exploits exogenous variation in the likelihood that an offender receives EM generated because (a) judges differ in their tendency to refer offenders for EM assessment, and (b) the assignment of cases to judges within the pool of available judges at a court is effectively random. This approach alleviates the bias due to selection into EM that occurs via the assessment process, as well as selection bias due to unobserved offender characteristics, because the decision to refer to assessment is made by the judge prior to assessment, and assignment of judge to case is as good as random.  

\footnote{Differences across courts in the utilization of EM have been noted repeatedly since the early days of its introduction. See, for example, (Heggie, 1999).}
To be more concrete, we use 2SLS to estimate the causal impact of serving a sentence under EM rather than in prison, where the first stage is given by:

$$EM_{i,0} = \alpha_{EM} \pi_{i(j)}^{EM} + \alpha X_i + \epsilon_{i,0}$$

(2)

where $\pi_{i(j)}^{EM}$ is the tendency of judge $j$ assigned to offender $i$ to refer eligible cases for assessment for EM. The structural model for the outcome of interest is given by (1) above. We include court by year fixed effects in the first stage and structural models because the assignment of case to judge occurs at the court level, and the pool of judges available for assignment to cases changes from year to year as judges are rotated across court complexes. By controlling for court by year fixed effects, we limit comparisons to offenders at facing the same set of judges. The within-cell variation in the instrumental variable can therefore be interpreted as variation in the tendency of a quasi-randomly assigned judge to refer an offender for EM assessment relative to other offenders seen in the same court in the same year (Aizer & Doyle, 2015; Dobbie et al., 2018).

2SLS provides consistent estimates of the causal parameters of interest if, in addition to the instrument being as good as randomly assigned (conditional on court by year fixed effects), the instrument is relevant in explaining whether individual $i$ before judge $j$ receives a sentence to be served under EM (relevance) and the instrument impacts on the outcome of interest only through its impact on EM sentencing (excludability). Further, under heterogeneous treatment effects, a Local Average Treatment Effect (LATE) interpretation requires that the instrument satisfies monotonicity. In our application, this requires that the probability that individual $i$ receives an EM sentence monotonically increases with the tendency
of judges to refer eligible cases for assessment for EM. If these assumptions are met, our empirical design identifies the causal impact of serving a sentence under EM for individuals who would have served their sentence in prison had they faced a different judge. We assess these conditions in Section 5 and Section 6.2. Section 6.2 examines the robustness of our results to the period over which reoffending is measured, and to functional form assumptions.

4 Data

The data used in this analysis are drawn from two sources. The first is the Reoffending Database (ROD) provided by the NSW Bureau of Crime Statistics and Research (BOCSAR). ROD links individual case-level data on all matters before Local, District, Supreme, and Childrens Criminal Courts in NSW, with adult and juvenile custody data. Information on the judge overseeing each case was linked to the ROD data by BOCSAR. The second source of data, on referrals to NSW Community Corrections for assessment for EM, is provided by Corrections Research Evaluation & Statistics, Corrective Services NSW. These data were linked by BOCSAR to the ROD data extracted for this study. The custody data are available from 2000. Given the changes in the administration of the EM program from the second half of 2007, we focus our analysis on sentencing that occurred over the period 2000–2007. The follow-up period over which we measure reoffending extends to September 2016.

From the ROD, we extract all individuals whose primary offense is eligible for EM and who receive a sentence of either prison or EM. This includes proven offenses for which the case judge deems imprisonment of a term of no more than 18 months to be the appropriate punishment. The requirement of eligibility for EM excludes the following offenses from our
sample: murder; attempted murder; manslaughter; serious assault resulting in injury; all
sexual assault and related offenses; abduction; harassment; other offences against the per-
son; importing, exporting, dealing, or trafficking illicit drugs; and prohibited and regulated
weapons and explosives offenses. We further restrict our sample to include only those judges
who presided over 10 or more cases eligible for EM over the period 2000–2007. As random-
ization of case to judge occurs at the court level, we also limit our sample to cases heard
in courts over which more than one judge presided in each calendar year. We also limit
observations to offenders living Sydney at the time they offended, as EM was not widely
available elsewhere in NSW over the time period we analyse. Our final restriction is to ex-
clude offenders who are identified as Indigenous in the ROD, as this group has a distinctly
different relationship with the criminal justice system.

After applying the above set of restrictions, the sample consists of 16,475 cases. We refer
to this sample as our full sample ans we use it to construct the judge tendency measure. The
sample used to estimate the structural parameter of interest consists of the first instance in
which an offender in the full sample is before a court for an EM eligible offense. This offense
is referred to as the index case, and we refer to the sample of index cases as our estimation
sample.8 There are 8,826 index cases in our estimation sample. Note that we have court
data until September 2016, so we are able to measure reoffending in our estimation sample
out to this horizon.

Table 2 shows the distribution of offenses in the full sample and the estimation sample
by the manner in which the sentence is served. There are three main points to take away

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8We use the term case and offender interchangeably, as there is only one index case for
each offender in our estimation sample.
from Table 2. First, for the full sample and the estimation sample, we observe sentences of EM and prison for each type of offense that is eligible for EM. Second, for the full sample and the estimation sample, the top three types of offences that are punished with EM are traffic, fraud, and government procedures, while the top three for prison are theft, traffic, and government procedures. The third point to take away from Table 2 is that the distribution of offense type for each form of punishment is similar across the full sample and the estimation sample. For example, in the full sample 47% of cases punished with EM have a traffic offence as their most serious offense, compared to 45% in the estimation sample. Similarly, in the full sample 20% of prison sentences are for traffic offenses, compared to 22% in the estimation sample.

4.1 Reoffending and the Cumulative Number of New Offenses

Reoffending is measured using an indicator equal to one if the individual is before the courts on new charges at any time within $t$ months of their index court case being finalized.\textsuperscript{9} It is measured cumulatively at 6-monthly intervals, starting 6 months and ending 10 years from the date that the index court case is finalized.\textsuperscript{10} In a sensitivity analysis we also consider reoffending within $t$ months of being released into the community, as measured from the date that offenders are released from prison or, for those serving their sentence under EM, from the date that their court case is finalized (since this is when sentences served under EM in

\textsuperscript{9}New offenses are defined as those that occur after the date of finalization of the index court case.

\textsuperscript{10}If the offender dies or the follow-up period ends before $t$ months have elapsed, the outcome variables are coded as missing. This reduces the number of index cases in our estimation sample from 8,826 at the time of case finalization to 8,610 108 months after finalization and 8,309 120 months after case finalization.
the community begin).

The cumulative number of new offenses is defined as the sum of the number of proven charges \( t \) months after the index court case is finalized. It is measured cumulatively at 6–monthly intervals, starting 6 months and ending 10 years from the date that the index court case is finalized.

### 4.2 Judge Tendency to Refer for Electronic Monitoring

The measure we use is based on the judge–specific leave–out mean rate of referral, constructed as the judge–specific average rate of referral for all other cases the judge has handled, before and after the index offense, that comprise our estimation sample. Following Bhuller et al. (2020) and Dobbie et al. (2018), we construct the judge tendency measure for EM as the residual from regressing the leave–out mean judge EM referral rate on a set of fully interacted court and year of finalization fixed effects. We do this because randomization occurs within the pool of available judges at the court level, which may change over time as judges are rotated across courts.

There are 139 judges and 52 courts in our estimation sample. The distribution of judge tendency to refer for assessment for EM for the estimation sample is shown in Figure 1.\(^{11}\) The mean tendency of judges to refer offenders for assessment for EM is 0.12 with a standard deviation of 0.08. Figure 1 reveals a substantial range in this tendency, with judges at the 95th percentile referring 25% of offenders for assessment for EM and those at the 5th percentile referring only 2%.

\(^{11}\)For ease of interpretation, we re-center the distributions by adding the average of the leave-out means to the residuals.
4.3 Control Variables

As noted earlier, all models estimated control for a full set of interacted court and year of finalization fixed effects. We also control for crime type (injury, negligent driving, break and enter, theft, fraud, public order, and traffic, with violations of government procedures as the omitted category), offender’s gender (with an indicator equal to one if the offender is male), and age. We additionally estimate models that control for an extended set of information, including the number of finalized court appearances in the five years prior to the index court appearance, an indicator for no legal representation during the court case, and a set of indicators for the local government area in which the offender lives. Descriptive statistics (sample mean and standard deviation) for the control variables can be found in Table 1.

4.4 Descriptive Analysis

Table 3 shows the reoffending rate by the manner in which the sentence is served for the estimation sample at 12 months through to 120 months after case finalization. It shows that 23% of offenders who are imprisoned are before the courts on new charges within 12 months of their index case being finalized, and this increases to 81% within 120 months. The reoffending rate for those who serve a sentence under EM is 11% within 12 months of index case finalization, increasing to 65% within 120 months.

The second panel of Table 3 shows that not only are those who serve a sentence in prison more likely to reoffend, they also commit a larger number of new offenses than those who serve an EM sentence. For example, in the 10 years after sentencing, those who were imprisoned are before the courts for an average of 10 new offenses compared to 5 for those
who served an EM sentence.

The descriptive statistics suggests that, compared to EM, imprisonment is associated with a greater likelihood of reoffending and a larger number of new offenses at all durations after sentencing. Of course, these associations could simply reflect favorable selection into EM. In order to determine the causal relationship between sentence type and reoffending, we follow the 2SLS approach described in the previous section.

5 Assessing the Instrumental Variable

5.1 Instrument Relevance

Table 4 contains the first-stage estimates. This table reports the key results from OLS regressions in which the dependent variable is an indicator equal to 1 if offender \(i\) before judge \(j\) receives a sentence to be served under EM. The explanatory variable of interest is the instrument: judge tendency to refer to EM assessment. We report on the specification that includes the full set of controls. Table 4 reports the coefficient estimate for the instrument, judge tendency to refer for assessment for EM, for the samples corresponding to durations of 12 months through to 120 months since index case finalization. Note that standard errors account for clustering at the court level.

As can be seen from Table 4, judge tendency to refer for assessment for EM is a highly significant predictor of the offender receiving a sentence of EM. Moreover, the estimated coefficient is not sensitive to the sample size used in estimation. We find that an increase in the judge tendency to refer to EM by one standard deviation (0.08) increases the likelihood
that the offender is sentenced to EM by around 4.4 percentage points, or 37%.

Table 4 also reports the $F$-statistic testing the significance of the instrument in the first-stage model, along with the Sanderson-Windmeijer under-identification test. As can be seen from the table, the $F$-statistic is much larger than the rule of thumb value of 10 across all time horizons. Also, the Sanderson-Windmeijer test leads to rejection of the null hypothesis that the model is under-identified for all time horizons. From Table 4 we conclude that the model is not under-identified, and that the instrumental variable is relevant and not weak.

5.2 Instrument Validity

The validity of our instrumental variable (IV) approach relies on the assumption that judge tendency to refer cases for EM assessment is as good as randomly assigned. As discussed in Section 2.2, we provide evidence consistent with this assumption in Table 1, which shows that although characteristics of the offender and case (conditional on interacted court and year of finalization fixed effects) are correlated with the probability that an offender receives a sentence of EM, they are not correlated with the tendency of judges to refer cases for EM assessment.

Further evidence on the conditional random assignment assumption is provided in Appendix Table A.1. This table reports on an extended analysis of the first-stage relevance of the instrument. If judges are as good as randomly assigned, then adding the predetermined variables (that are used as controls) should not significantly change the first-stage coefficient estimates on the instrument. As can be seen by looking across the specifications, as controls are added to the first-stage model, the point estimates of the coefficient on judge tendency
to refer to EM assessment do not change appreciably.

In addition to random assignment, in order for judge tendency to refer cases for assessment for EM to serve as an instrument, it must not impact on reoffending except through its effect on whether an offender is sentenced to EM. We investigate possible violations of this exclusion restriction, and conduct a more formal test in Section 6.2.

5.3 Monotonicity

Monotonicity implies that an offender who receives a sentence of EM from a judge who has a low tendency for referral will also receive a sentence of EM from a judge with a high tendency for referral. If monotonicity is satisfied, then our estimates uncover the impact of serving a sentence under EM among the subgroup who would have served their sentence in prison if their case had been heard by a different judge who was less inclined to use EM.

While we cannot directly test whether monotonicity holds in our sample, we follow previous studies in testing two implications of monotonicity (Aizer & Doyle, 2015; Bhuller et al., 2020; Dobbie et al., 2018). First, the impact of our instrument on the probability that an offender receives an EM sentence should be non-negative for any subsample. To examine this, we construct the judge tendency variable using the full sample, but estimate the first–stage on subsamples defined by crime type, by age, by gender, by whether the offender has been incarcerated in the past 5 years, and by whether the offender has legal representation. The results are reported in the first column of Appendix Table A.2. For all subsamples, judge tendency to refer for assessment for EM is positive and statistically significantly associated with the offender serving their sentence under EM.
The second implication of monotonicity that we investigate is that judges who are more inclined than others to refer for EM assessment for one type of offense should also be more inclined to do so for other types. For example, if judge \( j \) is more likely to refer traffic offenses for EM assessment, she should also be more likely to refer other offenses for EM assessment. If this is true, then the probability that offender \( i \) before judge \( j \) for a non-traffic charge receives a sentence of EM should be non-negatively related to judge \( j \)’s tendency to refer traffic offenses for EM assessment. This is referred to as the ‘reverse instrument’ (Bhuller \textit{et al.}, 2020). We report the coefficient estimates for reverse instruments in the second column of Appendix Table A.2. Reverse instruments are defined by crime type, gender, age, previous incarceration, and presence of legal representation. In all cases, the coefficient on the reverse instrument for referral for assessment for EM is positively related to the probability of receiving a sentence of EM, and in 10 out of 11 cases the reverse instrument is statistically significant. Overall, we conclude that there is no evidence to suggest that the assumption of monotonicity should be rejected in these data.

The above examines implications of monotonicity, and is a weak test of monotonicity. Strict monotonicity requires that subgroup specific judge tendencies monotonically increase with each judge’s overall tendency to refer cases for assessment for EM. In Section 6.2, we examine the joint hypothesis that both strict monotonicity and the exclusion restriction hold using the test described in Frandsen \textit{et al.} (2019).
6 Effect of Electronic Monitoring on Recidivism

6.1 Baseline Results

Figure 2 graphs the IV estimates of the impact of serving a sentence under EM on the probability of any reoffending (panel a) and on the cumulative number of new offenses (panel b) \( t \) months after the date of index court case finalization. Also shown are 90% confidence bands based on standard errors clustered at the court level.

*The Effect of EM on Reoffending:* Panel a of Figure 2 shows that 6 months after finalization of the index case, an offender serving a sentence under EM is more likely to reoffend than an otherwise similar individual serving their sentence in prison because they faced a different judge. Although this estimate is not statistically significant, it is consistent with expectations given that the median sentence for both EM and prison is 6 months, and the incapacitation effect is greater for prison than EM.\(^\text{12}\) Eighteen months after sentencing, the coefficient on EM is statistically negative, indicating that those who served their sentence under EM because they faced a judge who has a greater tendency to use it are (19 percentage points) less likely to reoffend than if they faced a judge who is less inclined to use EM. The coefficient on EM remains negative and generally statistically significant up to and including 114 months (9.5 years) after index case finalization. The marginal insignificance of the coefficient at 120 months likely reflects a loss in precision due to a reduction in sample size, as not all offenders are followed for the full 120 months.

The statistically negative impact of EM on reoffending is greatest at 30 months and 36

---

\(^{12}\)Appendix Figure A.1 graphs the distribution of sentence length for prison and EM sentences.
months after the index case is finalized. At these durations, those who serve an EM sentence due to facing a judge more inclined to use this form of punishment are 58% less likely to reoffend than those who serve their sentence in prison. Evaluated over longer periods, the coefficient on EM becomes somewhat smaller in magnitude and is fairly stable from 42 through to 84 months from the date of finalization of the index court case. Over this longer duration, those served an EM sentence are 23% less likely to offend than those who serve their sentence in prison. When the period of impact evaluation is extended beyond 7 years, the magnitude of the coefficient on EM reduces further and is marginally significant (at the 10% level). Nonetheless, it is impressive that 9.5 years after case finalization, those who served their sentence under EM because they face a judge with a greater tendency to use EM remain significantly less likely to reoffend, with a reduction in reoffending of 17% (compared to the average reoffending rate of 78% for those who served their sentence in prison).\textsuperscript{13}

\textit{The Effect of EM on the Number of Offenses}: In addition to the extensive margin of reoffending, we also consider the impact of serving a sentence under EM on the intensive margin of reoffending, measured by the cumulative number of new charges $t$ months after the index court case is finalized. As the number of charges displays significant variation, and in order to accommodate the zero number of offenses for those who do not reoffend (or have yet to reoffend), we use the inverse hyperbolic sine transformation of the cumulative number of new charges as the outcome variable.

The IV results are displayed in Figure 2 panel b. In line with the results for reoffending, Figure 2 panel b shows that the impact of serving an EM sentence on the number of new

\textsuperscript{13}Using the 5\% level of significance, coefficient estimates at 24 months, 90 months, 96 months, 104 months, and 114 months after court case finalization are also insignificant.
charges 6 months after index court case finalization is positive, though not significantly different from zero, and after 18 months it is significant and estimated to reduce the number of new offenses by 35%. Seven years after case finalization, EM is estimated to reduce the cumulative number of offenses by 57%, a reduction of over 4 offenses compared to the average number of offenses for those who served their sentence in prison. By 120 months (10 years) the average number of offenses is reduced by 45%, or around 4.6 offenses. This provides significant evidence that EM reduces offending on the intensive margin, and that this impact is evident 10 years after finalization of the index case.

Incapacitation versus Post-Sentence Effects? In our baseline model, we measure reoffending (and the cumulative number of new offenses) from the time that the offender’s case is finalized and they begin serving their sentence. As a consequence, the causal effects we estimate capture both incapacitation and deterrent effects and, all else being equal, the incapacitation effect is expected to be larger for those who serve their sentence in prison. Given that the maximum sentence length faced by offenders in order to be eligible for EM is 18 months, one way to better isolate the deterrent effect of electronic monitoring relative to imprisonment on reoffending is to focus on reoffending that occurs from 18 months after the index court case is finalized.

Table 5 reports estimates based on offending that occurs from 18 months after index court case finalization as well as from the date of court case finalization. We limit the follow-up period for this analysis to 84 months (7 years) after the index court case is finalized, as this is the period when the impacts remain strongest, both statistically, and in terms of

\[^{14}\] The coefficient estimates of the impact of EM on the cumulative number of offenses \( t \) months after sentencing are significant at the 10% level but not the 5% level at \( t = 18 \) months, 42 months, 54 months, 102 months, and 114 months.
the magnitude of effects. The IV results show that the impact of EM measured over the period 18–84 months and 0–84 months after index court case finalization are very similar, reducing reoffending by 0.16 and 0.15 percentage points, respectively. We also report results for reoffending that occurs 0–18 months following finalization. While the coefficient on EM is imprecisely estimated, its magnitude is similar to the coefficients estimated for 18–84 and 0–84 months after court case finalization. Overall, we conclude that our results suggest very little, if any, difference in the incapacitation effect of prison and EM.

Comparing OLS and IV: Table 5 also reports OLS estimates of the association between serving a sentence under EM and the outcomes of interest, any reoffending and the (inverse hyperbolic sine of the) number of new offenses, as well as reduced-form estimates of the impact of judge tendency to use EM on the outcomes of interest. In order to gauge the extent to which selection into EM on the basis of observables occurs, three specifications are reported for the OLS estimates. The first specification controls for court and year of finalization interacted fixed effects only. The second adds demographic characteristics of the offenders, and crime type to the list of controls. The third specification includes the full set of controls, which adds the number of court appearances in the five years prior to the index case, having no legal representation during the court hearing, and a set of indicators for the local government area in which the offender resides. Focusing on the last two columns and results for the full period of 0–84 months after case finalization, the OLS results for both the probability of reoffending and the cumulative number of charges reveals evidence of selection into EM on the basis of observable characteristics of the offender and offenses. For example, the estimated negative association between reoffending within 84 months of case finalization and receiving EM halves in magnitude from $-0.17$ when only court by
year of finalization fixed effects are accounted for to $-0.08$ when the full set of controls are accounted for. Similarly, the association between the (inverse hyperbolic sine of) number of new offenses and EM is $-0.60$ when only court by year of finalization fixed effects are included versus $-0.28$ when the full set of controls are included in the model. Finally, the reduced-form results demonstrate a statistically significant and negative association between a judge’s tendency to use EM rather than imprisonment and both subsequent reoffending and the number of new offenses.\footnote{Ex-ante, we expect that selection into EM is based on unobservable characteristics associated with a lower risk of offending. This is not inconsistent with finding IV estimates larger in magnitude than the OLS estimates in a heterogeneous effects model because IV estimates the LATE, which reflects the treatment effect for compliers. It is therefore helpful to understand who the compliers are, and we provide insight into this by characterizing compliers in Appendix Table A.3. This table shows that compliers are more likely than the average offender in our sample to be before the courts for a traffic offense, to not have been incarcerated in the 5 years prior to the index court case, to be female, and to not have legal representation.}

\section*{6.2 Examining the Exclusion Restriction}

In order for our IV estimates to have a causal interpretation, judge tendency to refer for EM assessment must affect reoffending only through the channel of receiving the punishment of electronic monitoring. A potential concern regarding this assumption is that judges may trade off severity of sentence type and severity of sentence length. Alternately, judges who are more severe in their choice of punishment type may also be more severe in terms of punishment length (Aizer & Doyle, 2015).

Appendix Figure A.1 graphs the cumulative distribution of sentence lengths for EM and prison. The median sentence is 6 months for both prison and EM. However, the distributions are somewhat different, with sentence lengths of less than 3 months or more than 12 months
being more common for prison than for EM. This would be expected if longer prison sentences reflected more serious offending, and setup and infrastructure requirements for EM (at a time when it relied on landline telephone connections) made it impractical to impose for sentences of short durations. Yet it is also possible that differences in sentence length and a correlation between judicial preferences for sentence type and sentence length contribute to differences in reoffending between those who who go to prison and those who serve an EM sentence.

These possibilities raise two potential threats to the exclusion restriction. The first occurs if judge tendency for sentence length has a direct effect on reoffending and is correlated with judge tendency to refer for assessment for EM. This can be addressed by including judge tendency for sentence length in the set of control variables. A second way in which the baseline model may violate the exclusion restriction is if sentence length directly impacts on reoffending (conditional on the manner in which the sentence is served and the control variables), and sentence length depends on the judge’s tendency to refer offenders for electronic monitoring assessment in addition to the their tendency for sentence length. This can be addressed by augmenting the baseline model to include sentence length as an endogenous regressor and instrumenting it with judge tendency for sentence length (defined as the mean adjusted residual from regressing the leave-out mean sentence length on a set of fully interacted court and year fixed effects) as follows:

\[
EM_{i,0} = \alpha_{EM} \pi_{i(j)}^{EM} + \alpha_{lg} \pi_{i(j)}^{lg} + \alpha' X_i + \epsilon_{i,0}^{EM}
\]

\[
LENGTH_{i,0} = \delta_{EM} \pi_{i(j)}^{EM} + \delta_{lg} \pi_{i(j)}^{lg} + \delta' X_i + \epsilon_{i,0}^{lg}
\]

\[
y_{it} = \beta_i EM_{i,0} + \lambda_t LENGTH_{i,0} + \theta_t' X_i + \nu_{i,t}
\]
where $LENGTH_{i,0}$ is the sentence length received by offender $i$ at the time that their court case is finalized and $\pi_{i(j)}$ is the sentence length tendency of judge $j$ assigned to offender $i$. Note that because judges are randomly assigned to cases, both judge tendency for sentence length and judge tendency to refer for assessment for EM monitoring satisfy the independence assumption.

Table 6 shows the results of including judge tendency for sentence length as an additional control variable in the baseline model in column 1, and augmenting the baseline model to include sentence length as an endogenous regressor in column 2. The outcomes of interest are an indicator for any reoffending and the cumulative number of new offenses 84 months after the index court case is finalized. The results in column 1 provide no evidence to suggest that the exclusion restriction is violated due to judge tendency for sentence length impacting reoffending. In particular, judge tendency for sentence length is uncorrelated with reoffending (conditional on the manner in which the sentence is served and the other control variables), and accounting for judge tendency for sentence length as an additional control has little impact on the estimated effect of EM, with the point estimate remaining unchanged at $-0.15$. Similarly, the results in column 2 shows that judge tendency for EM does not predict sentence length, and the coefficient estimate of the impact of sentence length on reoffending is not statistically significant. Overall, we conclude that it is unlikely that the exclusion restriction is violated through judge tendency for punishment type impacting on reoffending through sentence length.

While the above analysis focuses on a specific channel through which the exclusion restriction may be violated, it does not rule out the existence of other sources of violation. In order to probe this issue, we examine the joint hypothesis that the exclusion restriction
and strict monotonicity hold using the test recently developed by Frandsen et al. (2019). This test can be viewed as generalizing the Sargen over–identification test to a heterogenous treatment effects setting (Frandsen et al., 2019). Applied to our data, the test fails to reject the joint null (p-value is 0.15). This provides further evidence that the exclusion restriction and monotonicity are not violated in this analysis.

6.3 Robustness

Functional form: We examine the extent to which our findings are robust to alternatives to assuming linear functional forms for binary dependent variables by estimating a bivariate probit model where the structural outcome of interest is any reoffending. When the outcome of interest is the cumulative number of new charges, we follow the two-step procedure suggested in Wooldridge (2010), where the first step estimates a probit model for the binary outcome (sentenced to EM), and the fitted values are then used as the IV for 2SLS estimation of the structural model for the cumulative number of new charges.

Marginal effects and coefficient estimates for the impact of EM on reoffending and the number of new charges are reported in Appendix Figure A.2 along with the coefficient estimates from the baseline models. Panel a plots results for the outcome of any reoffending t months after court case finalization and panel b plots results for the outcome of cumulative number of offenses t months after court case finalization. Overall, a comparison of the two

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16We are grateful to the authors for generously sharing their stata code.
17We implement this test setting the fitweight equal to one (and the slope weight equal to zero) and with the number of knots points set at five. The value of the test statistic is 147.671 with fit degrees of freedom of 131. Increasing the number of knot points increases the p–value, as does increasing the weight on the slope.
18These are calculated for the bivariate probit model as the difference in the probability of reoffending when the EM indicator goes from 0 to 1.
sets of results for each outcome suggests that the estimated treatment effects are not very different and that our findings are robust to alternative functional form assumptions.

*Time at risk of offending:* Offenders sentenced to EM are released into the community on the date that their court case is finalized and their sentence begins. Those who serve a prison sentence are released into the community once their sentence is completed. While wearing an ankle bracelet may deter reoffending, it does not incapacitate offenders from reoffending in the way that imprisonment does. Therefore, reoffending from the time offenders are released into the community is of interest to policy makers who may be sensitive to concerns about reoffending occurring while offenders are serving an EM sentence.

Appendix Figure A.3 displays results from estimating models for any reoffending (panel a) and for the cumulative number of new offenses (panel b) where the time at risk of reoffending is measured from the date the offender is released into the community. These results are shown in the right hand side graphs. For ease of comparison, the estimates using time since case finalization are reported in the left hand side graphs. Comparing results for both outcomes demonstrates that the findings are not sensitive to whether they are constructed using time since being released into the community or time since court case finalization.

7 Discussion

In many western countries, the significant growth in prison populations and the attendant financial and social costs have led to an interest in sentencing alternatives to prison. A key concern when considering alternative punishments is whether moving away from a heavy reliance on prison will increase reoffending. In this paper we examine electronic monitoring
as a front-end alternative to prison for non-violent offenses. Our key objective is to evaluate whether the use of electronic monitoring rather than prison impacts on reoffending.

In order to identify causal effects, we address non-random selection of offenders into electronic monitoring using an IV approach based on judge tendency for punishment type. We evaluate the impact of serving a sentence under EM relative to prison up to 10 years since court case finalization. Our estimates provide evidence of significant reductions in reoffending at durations greater than 18 months after court case finalization among those who would have served a prison sentence had they faced a judge less inclined to use EM. For this group, we estimate that EM reduces reoffending by 22 percentage points 5 years after case finalization, by 15 percentage points 7 years after case finalization, and by 11 percentage point 10 years after case finalization. Similarly, we find quantitatively large impacts on reoffending at the intensive margin from around 18 months after court case finalization. The LATE of serving a sentence under EM rather than in prison is a reduction of 45 percent in the cumulative number of new charges, or 5 fewer charges per offender, 10 years after case finalization.

The interpretation of our findings as causal rests on several strong identifying assumptions. We carefully investigate each of these assumptions, including the exclusion of the instrument from the structural equation and monotonicity in the relationship between the instrument and the endogenous outcome, in order to establish the internal validity of our approach. We make a case for the external validity of findings for jurisdictions considering the use of EM as a front-end alternative for imprisonment based on the broad set of offenses and sentence lengths eligible for EM in the context studied, and the fact that the program itself is mature and operates at multiple locations.

It is important to note that in the context we study, EM both diverts offenders from
prison and provides individually tailored rehabilitation programs with intense supervision while the offender is living and working within the general community. With this in mind, and given the strong case for both the internal and the external validity of our findings, the policy implications are clear. Our results indicate that the combination of close monitoring and prescribed rehabilitation for non-violent offenders, as occurs under EM in the context we study, has sustained crime reducing effects. Given that it reduces reoffending at both the extensive and intensive margins for 10 years after court case finalization, we conclude that EM is a viable alternative to imprisonment.

References


Bhuller, M., Dahl, G., Løken, K., & Mogstad, M. 2020. Incarceration, Recidivism, and 

of Economic Literature, 55*(1), 5–48.

and Public Policy, 13*(3), 393–400.

Cost of Incarceration on Families.* Oakland, CA: Ella Baker Center.

Di Tella, R., & Schargrodsky, E. 2013. Criminal Recidivism after Prison and Electronic 

Dobbie, W., Goldin, J., & Yang, C. 2018. The Effects of Pre-Trial Detention on Conviction, 


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| F-stat | 37.42 | p-value | 0.00 |

Column 1 reports the results from a regression of an indicator for receiving a sentence of EM on the offender’s criminal and personal characteristics. Column 2 reports the results from a regression of the judge tendency to refer offenders’ for assessment for EM on the offenders’ criminal and personal characteristics. Coefficients and standard errors clustered at the court level (in brackets). The F-statistic and its p-value test the null hypothesis that the coefficients are jointly zero. The mean and standard deviation of the offenders’ crime and characteristics are reported in the final two columns. N=8,826

*** p<0.01, ** p<0.05, * p<0.1
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The full sample consists of all cases before the courts between 2000 and 2007 for which the offender is eligible to serve their sentence under electronic monitoring. The estimation sample consists the first instance that each offender in the full sample is observed before the courts. There are 16,475 cases in the full sample and 8,826 cases in the estimation sample.
<table>
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<td></td>
<td></td>
</tr>
<tr>
<td>Prison</td>
<td>23</td>
<td>45</td>
<td>57</td>
<td>64</td>
<td>69</td>
<td>72</td>
<td>74</td>
<td>75</td>
<td>77</td>
<td>81</td>
</tr>
<tr>
<td>EM</td>
<td>11</td>
<td>26</td>
<td>35</td>
<td>42</td>
<td>47</td>
<td>52</td>
<td>54</td>
<td>56</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Number of New Offenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prison</td>
<td>0.71</td>
<td>1.96</td>
<td>3.25</td>
<td>4.31</td>
<td>5.28</td>
<td>6.20</td>
<td>7.08</td>
<td>7.88</td>
<td>8.71</td>
<td>9.76</td>
</tr>
<tr>
<td>EM</td>
<td>0.25</td>
<td>0.78</td>
<td>1.49</td>
<td>2.15</td>
<td>2.63</td>
<td>3.10</td>
<td>3.58</td>
<td>4.06</td>
<td>4.50</td>
<td>5.21</td>
</tr>
<tr>
<td>Number of cases</td>
<td>8,787</td>
<td>8,751</td>
<td>8,736</td>
<td>8,720</td>
<td>8,701</td>
<td>8,694</td>
<td>8,688</td>
<td>8,682</td>
<td>8,610</td>
<td>8,309</td>
</tr>
</tbody>
</table>

Reoffending is defined as one or more court appearances (for an offense committed subsequent to the index offense) over the period starting from the time that the index case is finalized and ending t months after finalization of the index case.
Table 4: First–Stage Estimates: Dependent Variable is Sentenced Served is EM

<table>
<thead>
<tr>
<th></th>
<th>12 mths</th>
<th>24 mths</th>
<th>36 mths</th>
<th>48 mths</th>
<th>60 mths</th>
<th>72 mths</th>
<th>84 mths</th>
<th>96 mths</th>
<th>108 mths</th>
<th>120 mths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge tendency for EM</td>
<td>0.56***</td>
<td>0.56***</td>
<td>0.56***</td>
<td>0.55***</td>
<td>0.55***</td>
<td>0.56***</td>
<td>0.55***</td>
<td>0.55***</td>
<td>0.55***</td>
<td>0.55***</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>F stat (inst)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(1, 51)</td>
<td>51.79</td>
<td>51.15</td>
<td>50.71</td>
<td>51.04</td>
<td>51.71</td>
<td>54.94</td>
<td>54.96</td>
<td>55.78</td>
<td>55.55</td>
<td>59.86</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>SW underid test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi-sq(1)</td>
<td>54.58</td>
<td>54.27</td>
<td>53.81</td>
<td>54.17</td>
<td>54.88</td>
<td>58.31</td>
<td>58.34</td>
<td>59.21</td>
<td>58.98</td>
<td>63.64</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Observations</td>
<td>8,787</td>
<td>8,751</td>
<td>8,736</td>
<td>8,720</td>
<td>8,701</td>
<td>8,694</td>
<td>8,688</td>
<td>8,682</td>
<td>8,464</td>
<td>8,309</td>
</tr>
</tbody>
</table>

Controls include fully interacted court and year of finalization fixed effects, demographics (an indicator for gender is male, a quadratic in age), indicators for offense type is injury, negligent driving, break and enter, theft, fraud, public order, and traffic (the reference category is violating government procedures), the number of finalized court appearances in the 5 years prior to the index case, an indicator for no legal representation for the index case, and indicators for the local government area in which the offender resides. Standard errors clustered are the court level are reported in parentheses. *** p<0.01, ** p<0.05, * p< 0.1
Table 5: Baseline Instrumental Variable Results: Dependent Variable is Probability of Any Reoffending

<table>
<thead>
<tr>
<th></th>
<th>Pr(Reoffend)</th>
<th>Number charges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–18 months</td>
<td>18–84 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0–84 months</td>
</tr>
<tr>
<td><strong>OLS: Controls for Court X Year of Finalization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence is EM</td>
<td>-0.15***</td>
<td>-0.16***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.02)</td>
</tr>
<tr>
<td><strong>OLS: Add Controls for Demographics and Crime Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence is EM</td>
<td>-0.09***</td>
<td>-0.09***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.02)</td>
</tr>
<tr>
<td><strong>OLS: Add Controls for Criminal History and Legal Representation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence is EM</td>
<td>-0.08***</td>
<td>-0.07***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.02)</td>
</tr>
<tr>
<td><strong>Reduced Form: All controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge tendency for EM</td>
<td>-0.10</td>
<td>-0.09**</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.04)</td>
</tr>
<tr>
<td><strong>IV: All controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence is EM</td>
<td>-0.18</td>
<td>-0.16**</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.07)</td>
</tr>
</tbody>
</table>

Dependent mean 0.23 0.71 0.74 7.08
Number of observations 8,688 8,688 8,688 8,688

Demographic and offense controls include an indicator for gender is male, a quadratic in age, and indicators for offense type is injury, negligent driving, break and enter, theft, fraud, public order, and traffic. The reference category is violating government procedures. Criminal history and legal representation controls include the number of finalized court appearances within 5 years prior to the index case, an indicator for no legal representation in the index case, and indicators for the local government area in which the offender resides. Standard errors clustered at the court level are reported in parentheses. *** p<0.01, ** p<0.05, * p< 0.1
Table 6: Exclusion Restriction

<table>
<thead>
<tr>
<th>First-stage estimates</th>
<th>EM</th>
<th>EM</th>
<th>Sentence length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge tendency for EM</td>
<td>0.54***</td>
<td>0.54***</td>
<td>-0.11</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.62)</td>
</tr>
<tr>
<td>Judge tendency for sentence length</td>
<td>0.01*</td>
<td>0.01*</td>
<td>0.80***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>F-stat [ p-value]</td>
<td>49.81 [0.0000]</td>
<td>49.74 [0.0000]</td>
<td>152.81 [0.0000]</td>
</tr>
<tr>
<td>SW underid test [ p-value]</td>
<td>52.87 [0.0000]</td>
<td>52.80 [0.0000]</td>
<td>162.21 [0.0000]</td>
</tr>
<tr>
<td>Dependent mean</td>
<td>0.13</td>
<td>0.13</td>
<td>6.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IV estimates</th>
<th>Pr(Reoffend)</th>
<th>Number of offenses</th>
<th>Pr(Reoffend)</th>
<th>Number of offenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM</td>
<td>-0.15**</td>
<td>-0.49**</td>
<td>-0.15**</td>
<td>-0.49**</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.25)</td>
<td>(0.07)</td>
<td>(0.24)</td>
</tr>
<tr>
<td>Sentence length</td>
<td>–</td>
<td>–</td>
<td>-0.0010</td>
<td>-0.0030</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Judge tendency for sentence length</td>
<td>-0.001</td>
<td>-0.003</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent mean</td>
<td>0.74</td>
<td>7.08</td>
<td>0.74</td>
<td>7.08</td>
</tr>
</tbody>
</table>

Number of cases 8,688

All specifications control for interacted court and year of finalization fixed effects, an indicator for gender is male, a quadratic in age, indicators for offense type is injury, negligent driving, break and enter, theft, fraud, public order, and traffic (reference category is violating government procedures), the number of finalized court appearances within 5 years prior to the index case, an indicator for no legal representation in the index case, and indicators for the local government area in which the offender resides. Standard errors clustered at the court level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Estimation sample consists of 8,826 cases finalized between 2000 and 2007. The histogram shows the density of judge tendency to refer cases for assessment for suitability for the electronic monitoring program adjusted for court and year of finalization interacted fixed effects. The top and bottom 5% of observations have been excluded.
Figure 2 plots coefficient estimates of the impact of serving a sentence under EM on reoffending (panel a) and on the cumulative number of new offenses (panel b), and 90 percent confidence bands. Models control for interacted court and year of finalization fixed effects, an indicator for gender is male, a quadratic in age, indicators for offense type is injury, negligent driving, break and enter, theft, fraud, public order, and traffic (reference category is violating government procedures), the number of finalized court appearances within 5 years prior to the index case, an indicator for no legal representation in the index case, and indicators for the local government area in which the offender resides. Standard errors are clustered at the court level.
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Author/s:
Williams, J; Weatherburn, D

Title:
Can Electronic Monitoring Reduce Reoffending?

Date:
2022-03-01

Citation:

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