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ORIGINAL PAPER

The Effect of Removing Sentencing Credits on Inmate Misbehavior

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Abstract
Objective To examine the effect of prison officials' decisions to remove good time credits in response to prison rule violations on subsequent inmate misbehavior.
Methods Data pertaining to all inmates admitted to prison in a Midwestern state during 2009 who committed a rule violation were examined using two different methods, a multi-level analysis of a longitudinal person-period dataset and a comparison of the prison misconduct rates for inmates who lost good time during their first year of confinement to those for a matched control group of inmates who did not lose good time.
Results The multi-level longitudinal analysis revealed that inmates who lost good time in response to a prison rule violation were typically less likely to commit misconduct in the periods after they lost good time relative to periods before inmates lost good time, but the size of the observed effects were small. For the most part, the analyses of the matched sample of inmates who lost good time during their first year of confinement versus those inmates who did not lose good time revealed that losing good time did not affect inmates' rates of subsequent misconduct.
Conclusions Findings suggest that good time laws have little to no specific deterrent effects on inmate misbehavior.

Keywords Sentencing credits · Good time · Inmate · Prison misconduct · Deterrence

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Introduction

Sentencing credit laws such as good time or earned time laws offer prison inmates opportunities to reduce their prison sentence (Lawrence and Lyons 2011; Weisburd and Chayet 1989). Good time laws automatically award sentencing credits to inmates if they follow prison rules and regulations, while earned time laws typically award sentencing credits to inmates who participate in or complete designated programs (e.g., educational/vocational programming) (Lawrence 2009). An underlying assumption of sentencing credit laws is that they function as incentives for inmates to comply with prison rules and regulations; that is, they deter institutional misbehavior (Jacobs 1982; Royster v. McGinnis 1973; Weisburd and Chayet 1989). Yet few studies have examined the effects of these laws on inmate behavior. This gap in the literature is striking because sentencing credit laws have been in existence since the early nineteenth century (Weisburd and Chayet 1989), and because at least some form of these laws exists in 44 states (Lawrence 2009; Lawrence and Lyons 2011).[1] Moreover, prison officials' decisions to remove sentencing credits in response to inmate misbehavior have significant consequences for inmates' liberty interests, prison population sizes, and taxpayers, given the costs associated with lengthening an individual's term of imprisonment (e.g., Babcock 1981; Flanagan 1982; Henrichson and Delaney 2012; Schriro 2009). In order to provide greater insight regarding the effects of sentencing credit laws, we use data collected from a Midwestern state prison system to examine the effect of removing sentencing credits on inmate misbehavior.

A Sentencing Credit Law in a Midwestern State

The Midwestern state under study here is an indeterminate sentencing state with a sentencing credit law that automatically awards inmates six months of good time for each year of their prison sentence. However, prison officials may remove an inmate's good time credits in response to violations of the state's inmate rules and regulations. The rule and regulations prohibit 46 acts, which are divided into three different classes of offenses—Class I offenses (e.g., assault), Class II offenses (e.g., tattoo activities), and Class III offenses (e.g., tobacco products)—that reflect their seriousness and the maximum punishment that may be imposed. Inmates found guilty of a Class I offense in the state may lose up to two years of good time, whereas inmates found guilty of violating a Class II offense may lose up to three months of good time, and inmates found guilty of a Class III offense may lose up to two months of good time.

Following from the United States Supreme Court's decisions in *Wolff v. McDonnell* (1974) and *Sandin v. Conner* (1995), the state requires that an impartial committee hold a disciplinary hearing in order for an inmate to lose good time. The impartial committee is comprised of senior or supervisory personnel at each prison who have received training pertaining to inmate discipline from the state's legal counsel.[2] Individuals appointed to the disciplinary committee typically serve in this capacity for several years, and some individuals serve for over a decade. After a rule violation report is written, inmates receive

[1] Inmates can earn good time credits in 32 states, while 37 states have laws that afford inmates earned time credits; many states permit inmates to be awarded both types of sentencing credits (Lawrence and Lyons 2011).

[2] Disciplinary committee members recuse themselves from hearings pertaining to incidents in which they were a witness, reporting officer, or investigating officer.

notice of the hearing and the charges against them. The disciplinary committee then holds a hearing within seven days of the alleged rule violation and inmates may be present at the hearing, offer evidence, and call witnesses in their defense, although the hearings are closed to the public. At the conclusion of the hearing, inmates are provided with a written statement of the decision(s) pertaining to guilt, and if relevant, the corresponding punishment(s). Apart from the maximum penalties associated with offenses of different severity (e.g., Class I versus Class II), prison officials have the discretion to impose any available punishment(s) they deem appropriate in response to the rule violation. Punishments for violations range from the assignment of extra work to placement in segregation. Prison officials typically remove good time in addition to imposing other sanctions.[3]

Similar to other states with good time laws (e.g., Demleitner 2009; Jacobs 1982), judges in the Midwestern state routinely consider the impact of the law when determining how long to sentence a criminal defendant to prison (Pelka et al. 2014), and an individual's good time credits are applied to his or her sentence upon their admission to prison. An individual's maximum sentence length only changes if prison officials remove good time in response to a conviction for an offense prohibited by the rules and regulations. Thus, good time functions as an incentive for individuals to comply with the rule and regulations, but few studies have investigated whether this is indeed the case (Jacobs 1982; Weisburd and Chayet 1989).

Possible Effects of Removing Sentencing Credits on Inmate Misbehavior

Sentencing credit laws are expected to deter institutional misbehavior, both generally and specifically (Jacobs 1982; Weisburd and Chayet 1989). A few researchers have assessed the general deterrent effects of sentencing credit laws by comparing the behavioral outcomes (e.g., inmate misconduct, recidivism) of individuals sentenced to prison after a change in a state's sentencing credit law to the outcomes of individuals sentenced to prison before the change in the law. For instance, Emshoff and Davidson (1987) examined the effects of a change in a Michigan law which required individuals to serve their entire minimum sentence without receiving good time credits by comparing misconduct rates of eligible inmates sentenced after the law was enacted to misconduct rates for eligible inmates sentenced before the law was put in place. They found that the change in the law had no effect on rates of inmate misconduct or riot participation. Drake et al. (2009) evaluated a Washington law that increased earned release time for eligible non-violent offenders from 33% of their sentence to 50% by comparing eligible individuals sentenced to prison after the passage of the law to a matched sample of individuals sentenced to prison before the law was put in place. They found no differences between the rates of violent felony recidivism for the two groups, but the individuals sentenced to prison after the enactment of the law had a lower rate of felony recidivism. Bales and Miller (2012) examined the effect of Florida's shift to determinate sentencing and truth in sentencing, which required individuals to serve 85% of the court imposed sentence without the opportunity to earn good time credits. They found that inmates who were required to serve 85% of their sentence were more likely to commit violent, property, and disorderly

[3] During the study period, prison officials removed good time in addition to imposing segregation or cell isolation in over 90% of the cases examined. In states with overcrowded prisons (and segregation units), such as the state under study here, it is common for prison officials to impose cell isolation in lieu of segregation.

infractions. Memory et al. (1999) observed similar findings based on their examination of the effects of North Carolina's move to determinate sentencing.

To our knowledge, there have been no studies of the specific deterrent effects of losing sentencing credits on offender behavior.[4] Regarding these effects, scholars have emphasized the importance of the certainty, celerity, and severity of sanctions. This is because estimates of the certainty that sanctions will be imposed and the severity of those sanctions form the basis for individual calculations of the costs versus the benefits of offending (Durlauf and Nagin 2011; Nagin and Paternoster 1993). The celerity with which sanctions are applied affects individuals' association of the sanction and related behavior (Taxman et al. 1999). Formal policy in most states (including the state under study here) mandates that the certainty and celerity with which sanctions (i.e., removing good time) are applied is similar regardless of the type rule violation for which an inmate is convicted. Inmates may perceive that losing good time is more severe than other sanctions (e.g., privilege restrictions), however, because the loss of good time lengthens the amount of time they will serve in prison. Thus, it is reasonable to expect that losing good time could deter inmates from engaging in subsequent misbehavior.

On the other hand, removing good time could amplify an inmate's odds of subsequent misbehavior. Inmates who violate prison rules and have good time removed are often labeled high risk or problematic inmates (King et al. 2008; Riveland 1999). Inmates may identify with this label, be restricted from participation in rehabilitative programs, associate with other problematic inmates, and ultimately engage in subsequent misbehavior (secondary deviance) (Lemert 1951, 1967; Heimer and Matsueda 1994; Paternoster and Iovanni 1989). The official response to inmates who have lost good time may also subsequently intensify, which would increase the odds that subsequent rule violations would be detected (Marx 1981; Paternoster and Iovanni 1989; Wilkins 1964). Finally, inmates who lose good time might experience anger, frustration, or depression if they perceive that losing good time unjustly lengthened their prison sentence (Haney 2003; Kupers 2008; Smith 2006).

We seek to understand the effect of removing sentencing credits on prison inmates' behavior by examining this relationship using data collected from a Midwestern state's Department of Corrections. Given that an experimental design was not possible for this study (i.e., inmates cannot be randomly assigned to lose good time for legal and ethical reasons), we analyze the data using two different methods, each of which is described below.

Methods

Data

The target population for the study included all the inmates convicted of a rule violation and eligible to lose good time. We sampled all such inmates admitted to prison in the Midwestern state during 2009 (N = 1,410) and obtained official records pertaining to each

[4] The study conducted by Drake et al. (2009) could be considered an assessment of the effects of earning sentencing credits on offender behavior, but the researchers were unable to determine if all of the offenders in their sample earned additional release time. On average, however, inmates in their sample earned 60 additional days of release time (E. Drake, personal communication, 3rd November, 2014).

inmates' period of imprisonment through the study end date (July 2014).[5] Approximately 85% of the inmates had completed their prison sentence by the study end date. The advantage of this sampling strategy is that we were able to capture the beginning of each inmates' current period of incarceration (prior to any convictions for rule violations) and most the inmates' entire period of incarceration (inclusive of all convictions for rule violations). The disadvantage of the sampling strategy, however, is that the design raises the possibility of selection bias (e.g., we did not sample all inmates convicted of a rule violation during a particular time frame, but only those such inmates admitted during 2009); the sample is conditional on whether inmates admitted during 2009 were convicted of a rule violation and then whether they lost good time. We analyzed the data using two different methods and conduct some sensitivity analyses to better address the potential for selection bias, but the possibility that the selection processes associated with the sampling strategy affected the findings reported here cannot be completely ruled out.

For the first analysis, we created a longitudinal person-period dataset with weeks nested within inmates. Creating the person period dataset allowed us to assess within person changes in the odds of misbehavior after each time an inmate lost good time, as well as the effects of weekly changes in their behavior, supervision level (reflected by their security risk), and time served on subsequent misbehavior. We were also able to account for differences in exposure time across inmates reflected by their different lengths of imprisonment. Collectively, the 1,410 inmates in the sample served 161,248 weeks in prison.

The second analysis involved comparing inmates who were convicted of a rule violation and lost good time during their first year of imprisonment ($N = 183$) to inmates who were convicted of a rule violation and did not lose good time during their first year of imprisonment ($N = 1{,}106$). The decision to limit this analyses to inmates convicted of a rule violation during their first year of imprisonment was based on the need for an adequate follow-up period to assess whether losing good time had an effect on inmates' subsequent misbehavior [i.e., most individuals (71%) admitted to prison in the Midwestern state during 2009 served less than two years in prison]. Additionally, the majority of inmates who committed a rule violation (91%) and the majority of inmates who lost good time (70%) did so during their first year of imprisonment.

Measures

All of the measures used in the analyses are described in Table 1. The outcome measures displayed in Table 1 are described at the person-week level and reflect whether an inmate committed *any misconduct*, a *Class I misconduct*, or a *violent misconduct*. We examined violent misconduct and Class I misconduct separately from any misconduct in order to assess whether losing good time had an effect on either the nature or type of an inmate's subsequent serious offending in prison, as opposed to just subsequent offending.

For the first analysis, the predictor variables included both time varying characteristics measured at the person-week level and time stable characteristics measured at the person-level. The time varying characteristics included whether an inmate *lost good time 1x*, *lost good time 2x*, *lost good time 3x*, *lost good time 4x*, *lost good time 5x*, *lost good time* $> 5x$, their *prior violation history*, custody level (*security risk*), and amount of *time served*. We

[5] Inmates were removed from the sample if they had served their entire sentence in a local jail, were sentenced to life in prison, or were transferred to/from another jurisdiction ($N = 153$). Approximately 74% of the inmates admitted to prison in 2009 were convicted of a rule violation during the study period.

Table 1 Descriptions of sample for person-period analysis

Measures	Mean	SD
Outcomes		
Any misconduct	.08	.28
Violent misconduct	.01	.07
Class I misconduct	.01	.08
Within person predictors		
Lost good time 1x	.10	.31
Lost good time 2x	.03	.16
Lost good time 3x	.01	.12
Lost good time 4x	.01	.11
Lost good time 5x	.01	.09
Lost good time > 5x	.02	.15
Natural log of prior violation history	1.82	1.33
Security risk	26.03	6.21
Time served (weeks)	92.15	76.79
N_1 = 161,248 person weeks		
Between person predictors		
Age	36.74	10.79
Female	.13	.34
Black	.25	.44
Hispanic	.14	.34
Native American	.05	.21
Other race/ethnicity	.01	.12
Married	.21	.41
Child(ren)	.66	.47
High school diploma	.26	.44
GED	.34	.47
Gang membership	.10	.30
Mental health problems	.01	.12
Sex offender	.11	.32
Prior incarceration	.30	.46
Incarcerated for drug offense	.19	.39
Incarcerated for property offense	.28	.45
Incarcerated for public order offense	.16	.37
Natural log minimum sentence (months)	3.45	1.10
Natural log maximum sentence (months)	4.09	.91
N_2 = 1,410 inmates		

capped the measures reflecting the number of times an inmate lost good time at > 5x because only 2% of the inmates who lost good time did so more than five times. The time invariant characteristics measured at the person-level included an inmate's social demographics [*age*, sex (*female*), race/ethnicity (*black*, *Hispanic*, *Native American*, *other race/ethnicity*, *white*), marital status (*married*), *child(ren)*, and education (< *GED*, *GED*, *high school diploma*)], *gang membership*, *mental health problems*, criminal history (*sexual*

offender, *prior incarceration*, *incarcerated for drug offense, property offense, public order offense, violent offense*), and sentence length (*minimum* and *maximum*). The categories white, < GED, and incarcerated for a violent offense were treated as the reference categories for the measures of race/ethnicity, education, and incarcerating offense type. For the analysis involving the comparison of inmates convicted of a rule violation who lost good time during their first year of imprisonment to those convicted of a rule violation who did not lose good time, we measured all of the variables at the person-level.

Most of the measures described above are intuitive, while a few require explanation. Prior violation history is a count of the number of rule violations each inmate incurred prior to each time period, that was weighted to reflect the seriousness of those offenses (i.e., Class I = 3, Class II = 2, Class I = 1). We used the natural log of this scale to reduce the skew in the distribution. Security risk is the score derived from the Midwestern state's custody classification instrument, which ranges from zero to 40 and categorizes inmates into one of four risk levels that dictate the level of supervision inmates are subjected to. Prison officials periodically reassess inmates during their incarceration, and lower scores reflect higher risk. Gang membership reflects self-reported gang membership at the time of imprisonment. Mental health problems indicates whether an inmate was placed in a mental health unit during their imprisonment.[6]

Statistical Analyses

The first analysis involved the estimation of a hierarchical Bernoulli model using the longitudinal person-period dataset, where we nested repeated units of time (i.e., weeks) within inmates. Use of this technique and the corresponding person-period dataset allowed us to (a) examine observed changes in time varying characteristics (e.g., losing good time 1x, losing good time 2x) for each inmate, (b) adjust for the dependence among multiple observations within the same inmate, (c) permit the hypothesis tests to be based on the appropriate sample size (weeks versus inmates), and (d) remove between-inmate variation from the within person observations (through group mean-centering) that might have corresponded with differences in misconduct rates across inmates. Group mean centering also restricted the level-1 analyses to within person variation, permitting the examination of the effects of within individual changes in the time varying predictors on misconduct (Osgood 2010; Raudenbush and Bryk 2002). Assuming a sufficient number of distinct measures of time (an assumption met here), the bi-level analysis of the person-period data set also adjusts for problems (e.g., biased standard errors) associated with data that are unbalanced (Raudenbush and Bryk 2002; Singer and Willett 2002), such as those used here (i.e., inmates are imprisoned for different lengths of time).

In particular for this study, the multi-level longitudinal analysis permitted us to assess the effect of losing good time on inmates' odds of subsequent misconduct, independent of any person-level effects (owing to group mean centering). We were also able to control for the other time varying variables mentioned above, though the model is subject to the potential selection bias and related omitted variable bias resulting from any time-varying

[6] Not all of the inmates with mental health problems are placed in a mental health unit during their confinement in this Midwestern state. Therefore, the measure of mental health problems does not include all inmates who suffered from mental health problems during the study period. Further, the measure does not assess the severity or recentness of an inmate's problem. No other measures of inmates' mental illness were available electronically from the Midwestern state's Department of Corrections, however.

variables not included in the model (Osgood 2010).[7] Finally, use of the person-period dataset within the multi-level framework permitted us to assess the effect of losing good time (and losing good time multiple times) for the entire sample over the entire study period, which was most these inmates' period of incarceration (85%).

The analysis proceeded in several stages. First, an unconditional model revealed significant variance ($p \leq .05$) in each outcome at level-1 (within persons) and level-2 (between persons). Next, various specifications of the baseline model were examined in order to determine the appropriate representation for the main effect of time served. The level-1 predictors were then added to the models as fixed effects. We initially examined random effects, but these preliminary analyses revealed that none of the level-1 effects varied across inmates. The level-1 model intercepts were allowed to vary, however, permitting an examination of the main effects of the level-2 predictors on the level-1 intercepts.

For the second analyses, we used propensity score matching to develop a control group of inmates who were statistically equivalent to the inmates who received the treatment (i.e., lost good time during their first year of imprisonment), given the observed covariates.[8] The propensity score was created by first estimating a model of the odds of receiving the treatment (losing good time) that included all of the covariates described above and then saving the estimated propensity score (i.e., the conditional probability of losing good time given the observed covariates). Treatment cases (i.e., inmates who lost good time) were then matched to the available control cases (i.e., inmates who committed a rule violation during their first year of imprisonment, but did not lose good time) using a one-to-one nearest neighbor matching algorithm without replacement or a caliper restriction. The two groups were then assessed for balance using the standardized bias statistic (Rosenbaum and Rubin 1985); values < 20 are not significantly different. These analyses were carried out using the software R via the SPSS 23.0 R-Plugin developed by Thoemmes (2012). After the two groups were balanced, average treatment effects for the treated (ATT) and standard errors of those estimates were estimated.

Although propensity score matching is advantageous for generating control groups in order to estimate treatment effects when an experimental design is not possible, use of propensity score matching requires several assumptions (Guo and Fraser 2010). First, the stable unit treatment value assumption requires that the treatment is fully represented in the analysis and does not vary across treated cases in a manner that affects the outcome. Since we examined the effect of losing good time for the first time during an inmate's initial year of incarceration, one plausible violation of the stable unit treatment value assumption is if variation in the amount of good time an inmate lost coincided with variation their likelihood of perpetrating subsequent misconduct. We investigated this possibility as a part of the multi-level longitudinal analysis, and the results of our analysis (discussed later)

[7] An omitted variable could be prior sanctions (other than losing good time). We assessed the possibility of including several different measures or prior sanctions; however, each of these measures was highly collinear with prior violation history. We retained prior violation history because its' correlation with both losing good time and subsequent misconduct was stronger than the prior sanctions measures.

[8] As noted above, the second analysis was limited to inmates convicted of a rule violation during their first year of imprisonment in order to allow for an adequate follow-up period to assess whether losing good time had an effect on inmates' subsequent misbehavior—most individuals (71 percent) admitted to prison in the Midwestern state during 2009 served less than two years in prison. Further, the majority of inmates who committed a rule violation (91 percent) during their imprisonment did so during their first year, and the majority of inmates who lost good time (70 percent) lost good time in response to a violation during their first year of imprisonment.

suggest that the stable unit treatment value assumption was not violated.[9] Second, propensity scores are generated based on the observed covariates included in the model, and so the validity of the estimated treatment effects rest on the assumption that all the relevant covariates have been measured, and measured without error. Omitted covariates stemming from the selection processes or measurement error pertaining to the included covariates would contribute to hidden bias. Analyses involving propensity score matching cannot rule out hidden bias because it is unobserved, though sensitivity analyses can be conducted to determine the degree of the threat to the study findings posed by hidden bias. We performed sensitivity analyses for all significant treatment effects observed here. Finally, there must be substantial overlap between the propensity scores generated for the treatment and control group, implying that the two groups share a common support region. We examine the degree of overlap in the propensity scores estimated for the treatment and control group here.

Results

Before discussing the results of the analyses, it is worth noting that the 1,410 inmates admitted to prison in this Midwestern state in 2009 were convicted of 13,595 rule violations during the study period. Good time was removed in response to 6% of these violations, but 19% of the inmates convicted of a rule violation lost good time in response to at least one violation; 42% of those inmates lost good time in response to more than one violation.

Analysis of Person-Period Dataset

Table 2 contains the results of the multi-level longitudinal analysis of the effect of losing good time on misconduct. Recall that these analyses were designed to assess the effect of losing good time (and losing good time multiple times) on inmates' odds of perpetrating subsequent misconduct. We found that inmates who lost good time in response to violating prison rules had lower odds of committing misconduct in the period after they lost good time relative to the period before inmates lost good time. For the most part, this finding held regardless of the type of misconduct examined (e.g., any misconduct versus violent misconduct), and regardless of the number of times inmates lost good time (e.g., 1x versus 5x). Notable exceptions to these findings included the nonsignificant effects of losing good time 5x and losing good time > 5x on violent misconduct. The reduction in the probability of misconduct associated with losing good time was substantively small, however. Irrespective of the type of misconduct examined, and regardless of the number of times inmates lost good time, the probability inmates committed misconduct after they lost good time was approximately one percentage point lower than if they had not lost good

[9] Since good time is typically removed in addition to another sanction (e.g., segregation), it is possible that variation in the other sanction between the treatment and control group violated the stable unit treatment value assumption. We examined this possibility and found no significant differences in the other sanction received for those in treatment group versus those in the control group, assuming segregation and room restriction are treated the same. As noted, the prison system in the Midwestern state was severely overcrowded during the time of the study, and room restriction was frequently used by prison administrators in lieu of segregation due to the limited amount of segregation space (i.e., available segregation space in a prison is based on its design capacity).

Table 2 Longitudinal hierarchical Bernoulli models of effect of losing good time on misconduct

	Any misconduct		Violent		Class I	
	β	$s.e._{\beta}$	β	$s.e._{\beta}$	β	$s.e._{\beta}$
Intercept	*− 2.49*	.02	*− 5.49*	.05	*− 5.35*	.05
Within person predictors						
Lost good time 1x	− .15*	.05	− 1.01*	.15	− .88*	.14
Lost good time 2x	− .25*	.07	− 1.12*	.23	− .94*	.22
Lost good time 3x	− .32*	.09	− .82*	.26	− .89*	.25
Lost good time 4x	− .27*	.10	− .84*	.29	− 1.11*	.29
Lost good time 5x	− .73*	.13	− .83	.35	− 1.10*	.34
Lost good time > 5x	− .27*	.10	− .26	.29	− .80*	.28
Natural log of prior violation history	.28*	.02	.24*	.05	.57*	.06
Security risk	.01*	.003	.001	.01	.005	.01
Time served (weeks)	− .01*	.0002	− .004*	.001	− .01*	.001
N_1 = 161,248 person weeks						
Proportion variation within persons explained	.18		.11		.11	
Proportion variation within persons	.79		.75		.77	
Between person predictors						
Age	− .03*	.003	− .04*	.01	− .04*	.005
Female	.33*	.07	− .09	.15	− .38*	.15
Black	.29*	.06	.28*	.11	.27*	.10
Hispanic	.09	.08	.14	.13	.02	.13
Native American	.13	.11	.10	.19	.07	.18
Other race/ethnicity	.06	.14	− .15	.42	− .21	.39
Married	− .08	.07	− .27	.12	− .20	.11
Child(ren)	− .01	.06	− .15	.09	.03	.09
High school diploma	− .39*	.07	− .72*	.12	− .48*	.11
GED	− .19*	.06	− .40*	.10	− .32*	.09
Gang membership	.27*	.08	.17	.13	.03	.12
Mental health problems	.32	.19	1.26*	.27	.65	.27
Sex offender	− .17	.10	− .39*	.14	− .29	.13
Prior incarceration	.15	.07	.24	.10	.34*	.09
Incarcerated for drug offense	− .45*	.08	− .93*	.15	− .52*	.13
Incarcerated for property offense	− .12	.07	− .33*	.11	− .06	.10
Incarcerated for public order offense	− .13	.09	− .43*	.14	− .17	.14
Natural log minimum sentence (months)	− .03	.05	.09	.09	.34*	.10
Natural log maximum sentence (months)	− .07	.06	− .15	.10	− .32*	.10
N_2 = 1,410 inmates						
Proportion variation between persons explained	.31		.24		.24	
Proportion variation between persons	.21		.25		.23	

*$p \leq .01$

time.[10] The sole exception was the effect of losing good time 5x on any misconduct; inmates who lost good time 5x had a probability of committing misconduct three percentage points lower than if they had not lost good time.

Regarding the other predictor variables included in the model, inmates with more significant prior violation histories were more likely to commit misconduct, whereas inmates who had served more time had lower odds of committing each type of misconduct. Lower risk inmates had higher odds of perpetrating misconduct in general, but an inmates' security risk score had no effect on their odds of committing serious misconduct. Younger inmates, black inmates, those with less education, and inmates incarcerated for a violent offense were more likely to commit misconduct compared to older inmates, white inmates, those with more education, and inmates incarcerated for a drug offense. Women were more likely to commit any misconduct than men, but less likely to perpetrate a Class I misconduct. An inmate' sex had no effect on their odds of perpetrating violent misconduct. Gang members committed more misconduct than non-gang members, but gang membership had no effect on an inmates odds of committing either a violent or Class I misconduct. In contrast, inmates with mental health problems had higher odds of committing violent misconduct, but inmates with mental health problems were no more likely to perpetrate misconduct in general or Class I misconducts compared to those without such problems. Inmates designated as sex offenders, those incarcerated for a property offense, and inmates incarcerated for a public order offense were less likely to commit violent misconduct than non-sex offenders and inmates incarcerated for a violent offense. Inmates with a prior incarceration had higher odds of committing a Class I misconduct relating to inmates without an incarceration history. The inmate characteristics Hispanic, Native American, other race/ethnicity, married, child(ren), and sentence length were not associated with inmates odds of misconduct, with the exception of the positive effect of minimum sentence length and the inverse effect of maximum sentence length on Class I misconduct. Altogether, the significant within person predictors accounted for 18 (any), 11 (violent), and 11 (Class I) percent of the within person variation in misconduct, whereas the significant person-level predictors explained 31 (any), 24 (violent), and 24 (Class I) of the between person variation in misconduct.

Supplementary Analyses

We also investigated whether the effects of losing good time varied based on how much time an inmate had served. It could be that inmates who had served less time (and presumably had more time remaining to serve) were more deterrable than those who had served more time (and conceivably had less time left to serve). This is because inmates who lost good time earlier in their sentence would likely have more time to alter their behavior in an effort to earn back the good time that was lost relative to the inmates who lost good time later in their period of incarceration. We investigated this possibility by creating interaction terms between time served and each measure reflecting an inmate lost good time (e.g., lost good time 2x), and then individually adding these terms to the model to assess if the effect of losing good time was conditioned by time served. Only two of these interaction effects were significant; the inverse effect of losing good time 1x on violent misconduct became weaker the more time inmates had served (an amplification effect), while the effect of losing good time 5x became stronger the more time an inmate

[10] We used the formula provided by Hanushek and Jackson (1977) to transform the coefficient estimates into predicted probabilities. The other predictors in the model were held constant at their means.

had served (a deterrent effect). Since only two of the interaction effects were significantly associated with misconduct (out of 18 tests), however, it seems reasonable to conclude that the effect of losing good time was not conditioned by time served.

We also examined whether the effect of losing good time varied based on the amount of good time lost. During the study period, inmates lost increments of 15 days (18 percent), 30 days (42 percent), 45 days (23 percent), 90 days (16 percent), and $\geq$ 180 days (1 percent).[11] It could be that greater deterrent (or amplification) effects were associated with losing more good time relative to less. To assess this possibility, we restricted the person-period dataset to those inmates who lost good time during the study period ($N = 267$), and then examined the effects of losing different amounts of good time on the odds of misconduct relative to the odds of misconduct in the period before the inmates lost good time. We also added a control variable to the model reflecting the amount of good time inmates lost prior to receiving a new sanction involving the loss of good time. We present the within-person results in Table 3. We do not present the person-level results because they have little meaning, given the reduced sample used here. The within-person effects in Table 3 are still independent of person-level influences, however, because the level-1 predictor variables were group mean centered.

Consistent with the findings from our analysis of the effect of losing good time on misconduct (Table 2), Table 3 shows inmates who lost good time in response to violating prison rules had lower odds of committing misconduct in the period after they lost good time relative to period before they lost good time. These findings held irrespective of the amount of good time inmates lost. The reduction in the probability of misconduct associated with losing good time was substantively small, and similar regardless of the amount of good time inmates lost. The probability inmates committed any misconduct after they lost good time was approximately five percentage points lower than before they lost good time, while the probabilities inmates committed violent or Class I misconduct after they lost good time was approximately one percentage point lower than before they lost good time. The sole exception to this pattern of results was the effect of losing $\geq$ 180 days of good time on any misconduct; inmates who lost $\geq$ 180 days of good time had a probability of committing misconduct 10 percentage points lower than if they had not lost good time. The difference in the magnitude of the effect of losing $\geq$ 180 days did not hold for violent or Class I misconduct, however; as noted, the reduction in the probability of violent and Class I misconduct associated with losing good time was similar regardless of the amount of good time inmates lost. Thus, variation in the amount of good time inmates lost in response to rule violations typically did not coincide with differences in their probability of perpetrating subsequent misconduct.

Analysis of Matched Samples

The analysis of the matched samples was designed to assess the effect of losing good time for the first time during the initial year of inmates' incarcerative sentence relative to what would have happened if the inmates had not lost good time. Inmates who lose good time in this state typically do so in addition to receiving other sanctions, and so the counterfactual is receiving a sanction but not losing good time. The sub-samples of inmates convicted of a rule violation that lost good time during their first year of imprisonment and the inmates convicted of a rule violation who did not lose good time are described in Table 4, along

[11] The category 15 days included one seven-day sanction and one 14-day sanction. The category 90 days included one 60-day sanction and one 75-day sanction.

Table 3 Longitudinal hierarchical Bernoulli models of effect of losing different amounts of good time on misconduct

	Any misconduct		Violent		Class I	
	β	$s.e._{\beta}$	β	$s.e._{\beta}$	β	$s.e._{\beta}$
Intercept	*− 1.80*	.06	*− 4.32*	.07	*− 4.24*	.06
Within person predictors						
Amount of good time lost						
15 days	− .54*	.08	− 1.32*	.20	− .85*	.20
30 days	− .39*	.06	− 1.29*	.17	− 1.34*	.16
45 days	− .44*	.07	− 1.90*	.18	− 1.05*	.17
90 days	− .50*	.08	− 1.00*	.22	− 1.39*	.22
≥ 180 days	− 1.32*	.17	− 1.76*	.46	− 1.90*	.45
Prior amount of good time lost	− .0001	.0002	.001	.001	.001	.001
Natural log of prior violation history	.48*	.03	.51*	.07	.85*	.08
Security risk	.01*	.004	.001	.01	− .001	.01
Time served (weeks)	− .01*	.0004	− .01*	.001	− .01*	.001
N_1 = 44,254 person weeks						
Proportion variation within persons explained	.20		.15		.14	
Proportion variation within persons	.80		.82		.85	

*$p \leq .01$

with the significant differences between the samples. Table 4 shows that 1,289 inmates were convicted of a rule violation during their first year of imprisonment, and 183 (14 percent) of these inmates lost good time in response to a rule violation.

Table 4 shows that the inmates who lost good time were more likely to be younger, male, unmarried, without child(ren), less educated, involved in a gang, designated higher risk, sentenced to longer terms of imprisonment, have an indication of mental health problems, have a more significant history of rule violations, and have served more time in prison compared to the inmates who did not lose good time. In addition, the inmates who lost good time were less likely to have been incarcerated for drug or public order offenses compared to the inmates who did not lose good time. Based on the observed differences between the groups, it appears the inmates who lost good time were more at risk for subsequent misconduct than those who did not lose good time.

The results of the propensity score matching analysis are contained in Table 5. After matching, we were able to achieve balance between the groups, such that, there were no significant differences between the inmates who lost good time and the matched sample of inmates who did not lose good time for the observed covariates (standardized bias statistics < 20). In addition, the post-match propensity scores for the two groups were not significantly different, and a visual inspection of a histogram of these propensity scores indicated sufficient overlap of the distributions of the propensity scores for the treatment and control groups.

Table 6 contains the estimated average treatment effects for the treated (ATT) and corresponding standard errors. We examined both the prevalence and incidence rate of misconduct in order to determine whether losing good time was more relevant for

Table 4 Comparison of inmates who lost good time in first year of imprisonment versus inmates who did not lose good time in first year of imprisonment

Covariates	Lost good time		No time lost	
	Mean	SD	Mean	SD
Age	29.92	7.66	37.19*	10.54
Female	.00	.00	.16*	.37
Black	.32	.47	.25	.44
Hispanic	.14	.35	.14	.35
Native American	.06	.24	.04	.20
Other race/ethnicity	.00	.00	.02	.13
Married	.10	.30	.22*	.42
Child(ren)	.53	.50	.67*	.47
High school diploma	.11	.31	.27*	.45
GED	.36	.48	.34	.47
Gang membership	.25	.43	.08*	.28
Mental health problems	.05	.22	.01*	.10
Sex offender	.09	.28	.10	.31
Prior incarceration	.26	.44	.30	.46
Incarcerated for property offense	.31	.46	.28	.45
Incarcerated for drug offense	.09	.29	.20*	.40
Incarcerated for public order offense	.10	.30	.18*	.38
Natural log minimum sentence length (months)	3.60	1.07	3.37*	1.11
Natural log maximum sentence length (months)	4.22	.86	3.99*	.92
Natural log prior violation history	2.54	.71	1.67*	.72
Security risk	21.42	4.78	25.24*	5.39
Time served (months)	11.17	2.01	10.45*	2.67
N =	183		1106	

* Standardized bias statistic $\geq$ 20

understanding the frequency with which an inmate engaged in subsequent misconduct relative to whether they simply engaged in subsequent misconduct.[12] Treatment effects reflect the differences of the means for the respective outcomes across the treatment group and matched control group.[13] As can be seen from Table 6, losing good time had a positive (amplification) effect on whether inmates committed subsequent misconduct, regardless of the type of misconduct examined (any, violent, or Class I). Specifically, inmates who lost good time had a 10% higher probability of committing any subsequent misconduct, a 13% higher probability of perpetrating a violent misconduct, and a 14% higher probability of

[12] The distributions of the incidence of violent misconducts and the incidence of Class I misconducts were restricted to vary from 0-6 and 0-8, respectively, whereas the distribution of the incidence of misconducts was restricted to vary from 0-42. We restricted the distributions of these measures in order to capture more meaningful variation in these outcomes; less than 2% of the sample committed more than six violent misconducts or eight Class I misconducts, and less than 5% of sample committed more than 42 misconducts.

[13] The distributions of the incidence rate outcomes reported in Table 6 are skewed, and so significance tests were performed after transforming the distributions of the original limited counts of these events to negative binomial distributions and including an offset variable (time at risk) in the models.

Table 5 Comparison of inmates who lost good time in first year of imprisonment versus inmates who did not lose good time in first year of imprisonment after matching

Covariates	Lost good time		No time lost	
	Mean	SD	Mean	SD
Age	29.92	7.66	30.69	7.71
Female	.00	.00	.00	.00
Black	.32	.47	.32	.47
Hispanic	.14	.35	.10	.30
Native American	.06	.24	.07	.25
Other race/ethnicity	.00	.00	.00	.00
Married	.10	.30	.09	.28
Child(ren)	.53	.50	.56	.50
High school diploma	.11	.31	.11	.32
GED	.35	.48	.38	.49
Gang membership	.25	.43	.23	.42
Mental health problems	.05	.22	.02	.15
Sex offender	.09	.28	.08	.28
Prior incarceration	.26	.44	.27	.44
Incarcerated for property offense	.31	.46	.31	.46
Incarcerated for drug offense	.09	.29	.14	.35
Incarcerated for public order offense	.10	.30	.08	.27
Natural log minimum sentence length (months)	3.60	1.07	3.53	1.17
Natural log maximum sentence length (months)	4.22	.86	4.17	.99
Natural log prior violation history	2.54	.71	2.41	.67
Security risk	21.42	4.78	21.50	4.06
Time served (months)	11.17	2.01	10.99	2.16
N =	183		183	

* Standardized bias statistic $\geq$ 20

committing a Class I misconduct. However, losing good time was not related to the rate of misconducts inmates subsequently committed, and this finding held irrespective of the type of misconduct examined.

Supplementary Analyses

The results of the analysis of the effect of losing good time on the prevalence of misconduct with the matched sample differed from those observed from the longitudinal multi-level analysis, and so we performed a sensitivity analysis to determine the degree to which the results of the analysis based on the matched sample were threatened by hidden bias. We followed the framework offered by VanderWeele & Arah (2011) under the assumptions that: 1) the relationship between the outcome and the unmeasured covariate and the relationship between the treatment and the unmeasured covariate are the same across different levels of the observed covariates; 2) the unobserved covariate is dichotomous; and, 3) there is not a three-way interaction between the treatment, the outcome, and the unmeasured covariate. We calculated the bias and corresponding lower

Table 6 Effect of losing good time on subsequent misconduct

Outcomes	Lost good time		No time lost		ATT	s.e.$_{att}$
	Mean	SD	Mean	SD		
Prevalence						
Any misconduct	.73	.45	.63	.49	.10*	.05
Violent misconduct	.34	.48	.21	.41	.14*	.05
Class I misconduct	.40	.49	.26	.44	.15*	.05
Incidence rate (per month)						
# of misconducts	.43	.50	.38	.56	.05	.06
# of violent misconducts	.03	.05	.02	.07	.01	.01
# of Class I misconducts	.04	.06	.03	.08	.01	.01
N =	183		183			

* $p \leq .05$

95% confidence bound using a prevalence level of both .15 and .25 for the unobserved covariate among the control group. We found that an unobserved covariate would need to increase the odds an inmate lost good time and the odds an inmate perpetrated any subsequent misconduct by 35% (for prevalence level .15) or 30% (for prevalence level .25) to render the observed treatment effect nonsignificant. The observed covariate would need to increase the odds an inmate lost good time and the odds an inmate perpetrated subsequent violent misconduct by 279% (for prevalence level .15) or 264% (for prevalence level .25) for the observed treatment effect to be nonsignificant, whereas the observed covariate would need to increase the odds an inmate lost good time and the odds an inmate perpetrated a subsequent Class I misconduct by 282% (for prevalence level .15) or 267% (for prevalence level .25) for the observed treatment effect nonsignificant. Based on these results, the findings pertaining to any misconduct appear to be relatively sensitive to hidden bias, while the findings for violent and Class I misconduct are not very sensitive to hidden bias.

We also used the matched sample to estimate the effect of losing good time on subsequent misconduct after an additional covariate adjustment—the effect of time at risk. The Midwestern state under study here is an indeterminate sentencing state, and although we matched the treatment and control groups on both the minimum and maximum sentence imposed, losing good time necessarily increased the opportunity the treatment group had to perpetrate subsequent misconduct by lengthening their period of incarceration (time at risk). After controlling for the natural log of time at risk via logistic regression, the effect of losing good time on any misconduct was nonsignificant. The effect of losing good time on both violent misconduct and Class I misconduct remained significant, but the size of these effects diminished.

In sum, the findings from the analysis of the matched sample permit the following inferences. First, those inmates who lost good time during their first year of confinement had higher odds of perpetrating subsequent misconduct than inmates who did not lose good time. Second, the results of a sensitivity analysis and the analysis of effects after controlling for an additional covariate suggest that the effect of losing good time on any subsequent misconduct is less reliable than the effect of losing good time on subsequent violent or Class I misconduct. Third, once we adjusted the effects of losing good time on

subsequent violent or Class I misconduct for time at risk, the effects of losing good time were small. Finally, losing good time had no effect on inmates' monthly rate of subsequent misconduct.

Discussion and Conclusions

Sentencing credit laws exist in 44 states (Lawrence 2009; Lawrence and Lyons 2011). An underlying assumption of these laws is that they function as an incentive for prison inmates to comply with institutional rules and regulations (Jacobs 1982; Weisburd and Chayet 1989). However, only a few studies have examined the general deterrent effect of sentencing credit laws on inmate behavior, and we are unaware of any studies that have examined the specific deterrent effect of removing sentencing credits. An understanding of the effects of sentencing credit laws is important for promoting effective criminal justice policy, but also because prison officials' decisions to remove sentencing credits have consequences for inmates' liberty interests, prison population sizes, and taxpayers (e.g., Babcock 1981; Flanagan 1982; Henrichson and Delaney 2012; Schriro 2009). If sentencing credit laws are ineffective in curbing intuitional misbehavior, then it may be worthwhile to consider alternatives to these laws.

We analyzed data collected from a Midwestern state using two different methods in order to better understand the effect of prison officials' decisions to remove good time credits on inmate misbehavior. Our multi-level longitudinal analysis provided evidence in support of the idea that removing good time credits specifically deters inmate misbehavior, but the sizes of the observed effects were small. Our comparison of the misconduct rates of inmates who lost good time during the first year of their imprisonment to those for a matched sample of inmates that did not lose good time revealed that inmates who lost good time were typically no more likely to commit subsequent misconduct compared to those who did not lose good time, though we did find a few notable exceptions, where those who lost good time were more likely to commit misconduct.

The two different analyses produced different results; however, it is important to keep in mind that the analysis involving the matched sample was designed to examine the effect of losing good time for the first time during the initial year of an incarcerative sentence for a subsample of inmates who did as such. In contrast, the multi-level longitudinal analysis permitted us to assess the effect of losing good time (and losing good time multiple times) on inmates' odds of subsequent misconduct for the entire sample of inmates, and over the entire study period—the full term of imprisonment for most inmates. These differences in the two analyses likely contributed to the different findings observed here. The multi-level longitudinal analysis also yielded effects for losing good time that were independent of any person-level covariates (owing to group mean centering), though the findings are potentially subject to a omitted variable (or hidden) bias at the person-week level resulting from selection processes. The analysis of the matched sample is also subject to the same selection processes and related hidden bias at the person-level. In addition, the results of a sensitivity analysis and the analysis of treatment effects after controlling for time at risk suggest that the observed treatment effect of losing good time on any subsequent misconduct was less reliable than the effect of losing good time on subsequent violent or Class I misconduct; these effects, while reliable, were small once we adjusted the effects of losing good time for time at risk. And, losing good time had no effect on inmates' monthly rate of subsequent misconduct. For all of the reasons listed here, we place greater faith in

the results from the multi-level longitudinal analysis. Moreover, while we did observe some statistically different results between the two analyses, very few substantive differences emerged [i.e., a modest specific deterrent effect of losing good time (multi-level longitudinal analysis) versus mostly nonsignificant effects of losing good time (analysis of matched samples)].

Taken together, our findings lend some support to the notion that removing good time specifically deters inmate misbehavior. It could be that inmates perceive losing good time in addition to other sanctions as more severe than simply receiving other sanctions (e.g., segregation), and are thus, deterred from engaging in subsequent misconduct. On the other hand, it is important to keep in mind that the evidence in support of deterrent effects observed here was relatively small (i.e., losing good time was associated with approximately a one-percentage point decrease in the probability an inmate perpetrated subsequent misconduct). In addition, the analysis of the matched sample of inmates who lost good time during their first year of incarceration and those who did not lose good time typically revealed mostly nonsignificant effects of losing good time on subsequent misbehavior. Both sets of findings are subject to potential bias stemming from the selection processes, and so the evidence from the study cannot be treated as definitive. It seems reasonable to conclude, therefore, that our findings suggest that good time laws have little to no specific deterrent effects on inmate misbehavior, though additional research with more rigorous designs would be needed to support these claims. Future studies might want to employ a regression discontinuity design or an instrumental variable approach such as has been applied in criminal sentencing research (e.g., Green & Winik, 2010; Mitchell et al. 2017). Although the data used here did not permit the estimation of such models for this study, both strategies seem fruitful avenues for future inquiry.

The results of this study are only generalizable to the Midwestern state under study, and other comparable states that have a similar sentencing credit law. Although most of our findings suggest that the Midwestern state's good time law is achieving one of its goals (i.e., specific deterrence), albeit to a small degree, it is important to note that sentencing credit laws are also designed to generally deter inmates, reduce prison populations, and lower corrections related costs (Lawrence and Lyons 2011; Weisburd and Chayet 1989). Regarding general deterrent effects, there have been too few studies from which to draw meaningful conclusions, but those studies that do exist suggest that the general deterrent effects of good time laws are modest or nonexistent (Bales and Miller 2012; Emshoff and Davidson 1987; Memory et al. 1999). Any law that halves the sentences of most prison inmates would seemingly effect state prison populations and corresponding correctional costs. However, if judges typically consider the impact of the good time law when determining how long to sentence an offender to prison (e.g., Pelka et al. 2014), then these effects may not be that significant. Based on the available evidence then, good time laws, such as the one under study here may achieve some of their goals, but these effects are modest. Policy-makers must weigh such effects alongside the additional financial and social costs associated with imprisoning those who lose good time for longer periods. Additional research pertaining to the general and specific deterrent effects of such laws and their effects on prison populations and related costs is needed to understand the reliability and validity of this evidence, but if other studies yield similar findings or null findings, then the utility of good time laws should be questioned and reform of these laws considered. In order to avoid increases in prison populations and corresponding costs, however, any reform of a good time law should occur as part of a broader and comprehensive reform that also addresses sentencing practices and parole eligibility in the relevant state.

It is important to note a few potential limitations of this study. First, the outcome measures were based on official reports of inmate misconduct. Official measures of misconduct have been determined to be valid indicators of inmate behavior, but official measures of misconduct have also criticized because they are affected by under-detection and corrections officials' discretionary reporting (Steiner and Wooldredge 2014). Second, we were unable to assess the entire period of incarceration for some of the inmates (15 percent) included in the multi-level longitudinal analysis. Although it is possible our findings would have changed if we had been able to include these inmates entire period of imprisonment, we find this scenario unlikely because most inmates commit the majority of all of their misconduct within their initial years of imprisonment (Toch et al. 1989). Finally, it is worth reiterating that the validity of the findings from both our analyses hinges on whether we included all of the relevant covariates in our models. While we have no reason to suspect this is not the case, we cannot rule out the possibility of hidden bias owing to omitted variables resulting from the selection processes. Recall that the sample analyzed here is conditional on inmates admitted during 2009 being convicted of a rule violation and then whether they lost good time.

The limitations discussed above notwithstanding, the findings from this study of the effect of a Midwestern state's good time law provide some evidence that removing good time credits in response to prison rule violations may yield a modest specific deterrent effect on inmate misbehavior. Sentencing credit laws such as the one under study here exist in most states, but this is only one of a handful of studies of the effects of these laws. More studies of these laws are sorely needed. It is only through continued examination of the effects of these laws that policy makers can understand whether these laws work to achieve their intended goals.

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