

Testing for Racial Prejudice in the Parole Board Release Process: Theory and Evidence*

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Abstract

We develop a model of a Parole Board contemplating whether to grant parole release to a prisoner who has finished serving their minimum sentence. The model implies a simple outcome test for racial prejudice which is based on the released inmate's rate of recidivism and is robust to the inframarginality problem. Our model has several testable implications which we show empirical support for. Applying our test to data on all prison releases in Pennsylvania between 1999-2003 we find no evidence of racial prejudice.

Keywords: Racial Prejudice; Statistical Discrimination; Outcome Test; Parole; Recidivism

JEL Classification Codes: J7, I11

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1 Introduction

It has been widely documented that blacks comprise a disproportionate share of the U.S. prison population. According to the U.S. Bureau of Justice Statistics (BJS), there were a total of 2,297,500 inmates held in custody in state or federal prisons or in local jails as of June 30, 2009. Whites accounted for 34% of the incarcerated population, while blacks composed 39%, and Hispanics composed 20%.¹ In contrast, the fraction of whites, blacks, and Hispanics in the U.S. population is 64%, 12%, and 16% respectively.²

It is an important policy question to understand the causes of these racial disparities in incarceration rates. Although these disparities can potentially be caused by racial differences in crime prevalence, a growing literature has investigated the extent to which racial discrimination at various stages of the criminal justice system is responsible. Studies examining the role of prejudice in motor vehicle searches can reveal whether minorities are more likely to be caught for a given commission of crime (see Knowles, Persico and Todd, 2001, Anwar and Fang, 2006, and Antonovics and Knight, 2009). Starr and Rehavi (2012) find evidence that, conditional on being arrested for the same crime, prosecutors use their discretion to charge black defendants with more severe crimes. Anwar, Bayer and Hjalmarsson (2012) show that the racial makeup of the jury can have a large effect on the black-white conviction ratio. Other studies have looked at potential discrimination at the sentencing stage. In Pennsylvania, Steffensmeier and Demuth (2001) find that Hispanic defendants receive the harshest sentences, while Muhlhausen (2004) finds that black judges sentence black offenders to longer prison terms than white judges gave to white offenders. Ayres and Waldfogel (1994) and Bushway and Gelbach (2010) study the role of prejudice in bail setting, while Alesina and La Ferrara (2009) study the role of racial prejudice in death penalty sentences.

This paper studies whether discrimination plays a role in the last stage of the criminal justice system—the prison release process. Specifically, sixteen U.S. states still allow Parole Boards to have complete discretion over the release of prisoners, subject to the constraints of the prisoner’s prescribed minimum and maximum sentences.³ Given that Parole Boards have complete authority over how much of the prescribed sentence range the prisoner will serve, they are in the position to either remedy or exacerbate the biases that may be present in earlier stages of the criminal justice system. In this paper we examine whether the Parole Boards’ release decisions reflect racial prejudice using data on all Pennsylvania prison releases between 1999-2003.

Many previous studies have examined this issue using *action*-based tests, which essentially compare whether minorities serve a greater proportion of their sentence before being paroled than their white counterparts.⁴ However, it is well known that simple racial disparities in proportion served, even after controlling for observable characteristics of inmates, are not necessarily evidence that the Parole Board is racially prejudiced. These disparities may result from an omitted variables problem, which occurs when there are systematic differences across races in the inmates’ characteristics that are observable to

¹See Table 16 in *Prison Inmates at Midyear 2009* (West, 2010).

²See U.S. Census Bureau: “*The 2010 Census Brief: Overview of Race and Hispanic Origin*” available at: <http://www.census.gov/prod/cen2010/briefs/c2010br-02.pdf>

³Over the past 30 years many states have transitioned from the parole release system to truth-in-sentencing schemes which require prisoners to serve a fixed proportion of their sentence (Kuziemko, 2013).

⁴The results of these studies are discussed in Section 2.

and used by the Parole Board in their release decision, but that are unobserved by researchers. These disparities can also arise from statistical discrimination, which occurs when there is crucial information that is unobservable to the Parole Board, but that is correlated with inmate race. To deal with these issues we use an *outcome*-based test because, if applied properly, these tests can identify racial prejudice even in the presence of omitted variables and statistical discrimination, as racial prejudice will have a different impact on the outcome in question.

The specific outcome test we use is based on a simple model of the Parole Board’s release decisions.⁵ We consider a Parole Board who is contemplating whether to grant parole release to a prisoner who has just finished serving their minimum sentence and is thus eligible for parole. The Parole Board faces a trade-off. On one hand, releasing the prisoner on parole saves the imprisonment cost; on the other hand, it imposes a social cost if the prisoner has not been rehabilitated and commits crimes upon release. We show the Parole Board will choose to grant the prisoner parole if and only if their perceived rate of recidivism is at or below a certain threshold, where the rate is defined as the product of the perceived probability the inmate is not rehabilitated and the rate of recidivism for non-rehabilitated inmates.⁶ The Parole Board will use a lower threshold for minorities if they are prejudiced against them. If the inmate’s rate of recidivism at the completion of their minimum sentence is too high, the Parole Board will keep the inmate incarcerated; each successive time period the inmate completes with good behavior increases the Parole Board’s perception the inmate is rehabilitated, and thus lowers their perceived rate of recidivism. The moment the inmate’s perceived recidivism rate is lowered enough to hit the Parole Board’s threshold, they are released. If the inmate’s perceived rate never falls enough to hit the threshold, they will be released upon the completion of their maximum sentence. Importantly, this implies that every prisoner granted parole release *between* their minimum and maximum sentences has an assessed recidivism rate *exactly* equal to the aforementioned race-specific threshold.

To implement our outcome test for racial prejudice we need to identify the release thresholds being used for each race and compare them. As is well-known, the main difficulty that arises when implementing outcome tests is the “infra-marginality problem”, which refers to the difference between the comparisons of the average and marginal outcomes across racial or gender groups.⁷ In order to identify the threshold being used, we need to identify the recidivism rate for the marginal person that is released (i.e. the person released whose rate is exactly at the threshold). Generally, though, without having access to all of the information the Parole Board has, the marginal person cannot be identified. This typically results in only the average recidivism rate being identified. We deal with the infra-marginality problem in this paper by noting that in our model, every prisoner released by the Parole Board *between* their minimum and maximum sentence, regardless of their characteristics, will have a recidivism rate exactly equal to the threshold set by the Parole Board. Therefore, within this subsample, the marginal prisoner released is the same as the average prisoner released and thus our application of the outcome test is not subject to the

⁵Our model is related to Bernhardt, Mongrain and Roberts (2010), although the goal of their paper is to show the efficiency of the parole board release system, instead of testing for prejudice.

⁶We assume rehabilitated inmates do not recidivate.

⁷See Knowles, Persico and Todd (2001) and Anwar and Fang (2006) for descriptions of this problem, and see Persico (2010) for a comprehensive review of the recent racial profiling literature.

infra-marginality critique.⁸

Our test for racial prejudice is based on our model of Parole Board behavior. As such, evidence for or against racial prejudice using our test is only as credible as our proposed model. Fortunately, our model has three auxiliary implications that can be tested using our data set. We find supportive evidence for all three of these predictions. Applying our test to the data we find no evidence that racial prejudice plays a role in Pennsylvania’s Parole Board release process.

The remainder of the paper is structured as follows. In Section 2 we review the related literature. In Section 3 we describe the sentencing and parole system in Pennsylvania in detail. In Section 4 we present a model of how the Parole Board makes parole release decisions and, based on the implications of the model, derive an estimation equation that will inform us about whether racial prejudice plays a role in the Parole Board’s decision making. Section 5 describes our data set and presents the descriptive statistics, while Section 6 presents our main empirical results regarding the role of prejudice in Parole Board decisions, as well as additional evidence supportive of the auxiliary predictions of the model. In Section 7 we run the action-based tests used in prior literature to show what we would have concluded if we used this flawed approach. Finally, Section 8 concludes.

2 Related Literature

Research that specifically examines racial prejudice in the parole release process has been rather scarce. The majority of the previous literature falls into two main categories. The first type of study essentially examines whether minorities serve a greater proportion of their sentence before being paroled than their white counterparts (Morgan and Smith, 2008). The findings have been mixed. Petersilia (1983) found that minorities in Texas served a higher proportion of their sentences relative to whites, but the reverse was true in Michigan. More recently, Huebner and Bynum (2006) found race had no effect on sentence served among a sample of men incarcerated for sexual offenses.

The second strand of literature uses data from parole decisions and explicitly examines whether race has an effect on parole being granted. Carroll and Mondrick (1976) examined the cases of 243 prisoners who appeared before a Parole Board between 1970-1971 and find that race had no impact on the decision to grant parole. In a more recent study, Morgan and Smith (2008) again found that race had no effect on parole release decisions using a sample of 762 inmates in Alabama that were eligible for parole between 1993-1994.

All of the above literature makes varying attempts to control for potential confounding factors, although none have access to all of the information the Parole Board has at the time of release. This opens the door for any potential racial disparity found to simply be the product of an omitted variables problem. Even if there were no omitted variable problem, these studies still could not differentiate between statistical or taste discrimination (racial prejudice), because they both have the same impact on the dependent variable.

Our paper is most closely related to a recent paper by Mechoulan and Sahuguet (2012) which also

⁸Similar ideas to deal with the inframarginality problem in the outcome test for racial prejudice were also used by Ayres and Waldfogel (1994) and Anwar and Fang (2012).

uses an outcome test to test for racial prejudice in parole release decisions.⁹ However, our paper differs from Mechoulan and Sahuguet in both modeling and data, which leads to us running different empirical tests and finding different conclusions. While we find no evidence of racial prejudice in the parole release process, Mechoulan and Sahuguet conclude that blacks are actually favored in the release process. In Appendix A we detail the specific differences between the approaches and show empirical evidence that, in our data set, only our model is supported.

3 Criminal Sentencing and Parole Release in Pennsylvania¹⁰

All individuals in Pennsylvania convicted of a crime are sentenced by a judge who determines their minimum and maximum sentence.¹¹ Offenders with a maximum sentence of less than two years are sent to jail. For offenders that have a maximum sentence between two to five years, the sentencing judge has discretion over whether to send them to jail versus prison.¹² Offenders with a maximum sentence greater than five years are automatically sent to prison. Individuals sent to prison must serve at least their minimum sentence. Once they have completed this, Pennsylvania’s Parole Board, which consists of nine members appointed by the governor, has complete discretion over when to release them, up until they reach their maximum sentence.¹³

Approximately four months before the inmate completes their minimum sentence, board members and hearing examiners will review the inmate’s file. The board uses this information to fill out the Parole Decisional Instrument form, which serves as a guideline for release. The instrument takes into account the type of conviction offense (non-violent or violent), the level of risk (low, medium, or high) of returning to prison for a new offense or violation according to the Level of Service Inventory-Revised (LSI-R),¹⁴ institutional programming completion, and institutional behavior. The inmate receives scores for each of these four critical dimensions, which are summed up to calculate an overall score.¹⁵ Scores from 2 to 6 “suggest parole”, while scores of 7 or greater “suggest parole refusal”.

The board is not bound by these guidelines when casting their vote, however, and can take into account other factors such as the recommendation of the sentencing judge, prosecuting attorney, and warden, as well as their general impression of the inmate during the parole interview. The decision makers for each case depend on the type of offense committed. For non-violent offenses, a hearing examiner and one board

⁹Our paper and Mechoulan and Sahuguet (2012) were developed simultaneously.

¹⁰Unless noted otherwise, the information regarding the parole release process described in this section comes from the website of Pennsylvania’s Board of Probation and Parole: http://www.pbpp.state.pa.us/portal/server.pt/community/reports_and_publications/5358/publications/617822

¹¹The judge is aided in their decision by the sentencing guidelines, which consist of a grid containing a range of suggested minimum sentences, where the offender’s offense gravity score of their current offense is on one axis, and their prior record score (measuring their prior criminal activity) is on the other axis. Judges are not required to conform to these guidelines.

¹²The sentencing judge has discretion over when individuals sent to jail are released.

¹³Once this is reached, they “max out” and must be released.

¹⁴The LSI-R is a quantitative survey of offender attributes and their situation, and is designed to help predict recidivism.

¹⁵For example, an offender receives three points for serving a sentence for a violent offense, receives three points if they have an unacceptable program compliance, receives three points if the LSI-R considers them high risk, and receives five points if they have a record of serious misconduct in prison (Goldkamp, 2010).

member will vote on the case. For violent offenses (except sex crimes and murder), two board members will vote on the case. The inmate must receive two affirmative votes to be granted parole. For murder and sex offenses, the full board reviews the case, and the majority of the board must approve the inmate’s release. Approximately 70% of the final case decisions follow what the Parole Decisional Instrument recommends.

Individuals that are not granted parole are given a list of specific requirements to be fulfilled by the time of the next parole review, which is usually within six months to a year. Individuals that are granted parole are released and monitored by parole officers. They can be returned to prison if they have a technical violation of their parole requirements, or if they commit a new crime.¹⁶

4 A Model of the Parole Board’s Behavior

In this section we propose a simple continuous-time learning model of the Parole Board which is adapted from the model developed in Bernhardt, Mongrain and Roberts (2010). We derive several implications and use these to test whether the Parole Board exhibits racial prejudice in their release decisions.

4.1 The Model

We model the Parole Board’s behavior from the first moment inmate i becomes eligible for parole release, which occurs after they have served their minimum sentence \underline{T}^i . At that time the Parole Board observes a set of information which it uses in its parole release decision. Some of the information is available to researchers, while some of it will not be. For example, information regarding the inmate’s conviction (type of crime committed and the sentencing terms), and their basic demographics (gender, race and age) are observed in our data set; however, we do not observe any information that is likely contained in an inmate’s prison dossier, including the behavior and incidents of the inmate while in prison and their general demeanor. We denote the information available to the Parole Board about inmate i at time \underline{T}^i by $(r, c_{\underline{T}^i})$ where r stands for the race of the inmate and $c_{\underline{T}^i}$ for all other information. For simplicity, we assume that the race of a prisoner is either white, denoted by W , or minority, denoted by M ; i.e., $r \in \{W, M\}$.

Rehabilitated or Non-rehabilitated. We assume that once the inmate completes their minimum sentence they are either “rehabilitated” or “non-rehabilitated”, and that their type does not change from that point on. In our model, there are two major differences between a rehabilitated and a non-rehabilitated inmate. First, a rehabilitated inmate will not recidivate, while a race- r non-rehabilitated inmate will recidivate at Poisson arrival rate $g_r > 0$ if parole released.¹⁷ Second, when imprisoned, a race- r non-rehabilitated inmate will be involved in prison incidents at a Poisson arrival rate $\lambda_r > 0$; however, rehabilitated inmates will not be involved in prison incidents. Prison incidents can be thought of as any event in prison that will negatively affect the probability of parole, such as misconduct with other prisoners or guards, or not com-

¹⁶Common reasons for technical parole violations include failure to report to a parole officer, carrying weapons, travelling too far from home, not maintaining employment, and failing drug and alcohol tests (Petersilia, 2003). Parolees receive an average of five violations before being returned to prison.

¹⁷In Section 4.4.1 we discuss how recidivism will be measured.

	Nonrehabilitated	Rehabilitated
In	$B - D_r$	$B - D_r$
Out	$g_r C$	0

Table 1: The Parole Board’s Flow Costs from Race- r Inmates

pleting required programming. Note that we allow both the recidivism rate for non-rehabilitated parolees and the incident arrival rate for non-rehabilitated inmates to depend on their races. The former is especially important as minorities and whites are likely to be parole released into very different environments, which can have an effect on their future criminal behavior.

Parole Board’s Payoffs, Belief Evolutions, and Release Decisions. At any time after inmate i has served their minimum sentence \underline{T}^i and before their maximum sentence \bar{T}^i , the Parole Board needs to decide whether to keep the inmate imprisoned or grant parole release. Suppose that the cost of holding a prisoner for a particular time period is B , regardless of the race of the prisoner and whether they are rehabilitated.¹⁸ The cost of releasing a non-rehabilitated inmate of race- r for a particular time period is $g_r C$, where g_r is the rate at which a non-rehabilitated race- r inmate will recidivate during that time period, and C is the cost to the Parole Board that results from the inmate recidivating.

The Parole Board can also obtain a *psychological benefit* $D_r \geq 0$ from keeping a race- r prisoner imprisoned. If the Parole Board is prejudiced against a particular race of inmates they are likely to feel a higher psychological benefit from keeping them imprisoned.¹⁹ This idea is summarized in the following definition:

Definition 1. *We say that the Parole Board is prejudiced against race- r inmates if $D_r > D_{r'}$ for $r \neq r'$.*

The costs associated with releasing a race- r prisoner for a particular time period is summarized in Table 1. We assume that $0 < B - D_r < g_r C$. These parameter restrictions imply that, if the Parole Board knows for certain that a prisoner is rehabilitated, it prefers that the inmate be released; on the other hand, if the Parole Board knows for certain that an inmate is non-rehabilitated, it prefers that the inmate be imprisoned.

Because a parolee will return to prison if they recidivate, the Parole Board’s decision of whether to release a prisoner on parole is simply to compare the cost of keeping them incarcerated for the next period with the cost of releasing them for the next period.²⁰ For the purpose of this comparison, let us denote by π_t^i the Parole Board’s belief at time t that inmate i is of a rehabilitated type for some $t \geq \underline{T}^i$. (We will

¹⁸In the empirical section this time period corresponds to one month.

¹⁹If the Parole Board is prejudiced against minority inmates, we are essentially saying $D_W = 0$ and $D_M > 0$, so that the cost of imprisoning minorities for an extra period is less than compared to whites due to this extra psychological benefit. This is similar to the racial profiling literature, whereby prejudiced police officers enjoy searching minorities more, and thus the cost to search them is less (see Knowles, Persico and Todd (2001) and Anwar and Fang (2006)).

²⁰If the parolee does not recidivate at time t they will remain on parole for time $t' = t + \epsilon$, where $\epsilon > 0$ is small. When we discuss the evolution of the Parole Board’s beliefs in the next section it will be evident that if it is profitable for the board to release the inmate at time t and the inmate does not recidivate at time t , it will be even more profitable for the board to release the inmate at time t' . Thus when deciding to release an inmate, comparing the costs and benefits at time t is all that matters.

describe the evolution of the Parole Board’s beliefs next.) The Board will release the prisoner on parole if and only if the cost of releasing them is lower than the cost of keeping them incarcerated at time t :

$$\begin{aligned} (1 - \pi_t^i) * g_r C &\leq B - D_r \\ \Leftrightarrow \pi_t^i &\geq 1 - \frac{B - D_r}{g_r C} \equiv \pi_r^*. \end{aligned} \quad (1)$$

Thus, the Parole Board will grant parole release to inmate i only if it is sufficiently confident that i has been rehabilitated. Importantly, the threshold π_r^* defined in (1) is increasing in D_r . This means that if the Parole Board is prejudiced against race- r inmates, they need to be more certain (probabilistically) that race- r inmates are rehabilitated before granting parole release. Intuitively, if the Parole Board is prejudiced against race- r inmates, then the the cost of incarcerating race- r inmates is lower, and consequently at the indifference point the cost of releasing them must also be lower. We summarize the above discussion by the following proposition:

Proposition 1. *The Parole Board will grant parole release to a race- r inmate at the first point in time between \underline{T}^i and \bar{T}^i when its belief about the inmate being rehabilitated exceeds π_r^* .*

The Parole Board cannot perfectly know whether the prisoner is rehabilitated or not at the time of the parole decision. Instead it forms beliefs based on available information, beginning at the time period when prisoner i has just completed their minimum sentence \underline{T}^i . We denote $\pi_{\underline{T}}^i \equiv \pi(r^i, c_{\underline{T}}^i)$ as the Parole Board’s belief given information $(r^i, c_{\underline{T}}^i)$ that the prisoner has been rehabilitated at time \underline{T}^i . Figure 1 shows the relationship between the evolution of the Parole Board’s beliefs and their release decisions for eight race- r inmates who have *no incidents* while in prison, but enter the prison with different characteristics.²¹ The vertical axis measures the evolution over time of the Parole Board’s beliefs that these prisoners are rehabilitated. In particular, for prisoners 1-3, upon completion of their minimum sentence \underline{T} , the Parole Board’s belief that they are rehabilitated, $\pi_{\underline{T}}^i$, already exceeds the threshold π_r^* , and thus the Parole Board will release them immediately.

For prisoners 4-8, however, $\pi_{\underline{T}}^i < \pi_r^*$, and thus these inmates will not be released immediately at \underline{T}^i . Their specific time of release will then depend on the evolution of the Parole Board’s belief of π^i . Recall that the Parole Board will use all available information about prisoner i at time t to form their belief π_t^i . Although most of this information is static (such as prisoners’ demographics and crime committed), the one component that will change over time is whether or not they are involved in prison incidents. We now derive the differential equation that governs how π_t^i changes over time.

Consider a small interval of time Δ between t and $t + \Delta$. Because we assume that prison incidents arrive according to a Poisson process, we know that when Δ is small, there are two possible outcomes between t and $t + \Delta$: the first outcome is that an incident occurs in this time interval and the second outcome is that no incident occurs. If an incident occurs, then the belief of the Parole Board will immediately decrease to 0 and remain there up through \bar{T} , because only non-rehabilitated inmates will be involved in an incident. If no incident occurs, then the Parole Board will update its beliefs using Bayes’ rule. Noting that a race- r

²¹To keep the figure simple all eight prisoners have the exact same sentence, but this assumption has no impact on the results presented in this section.

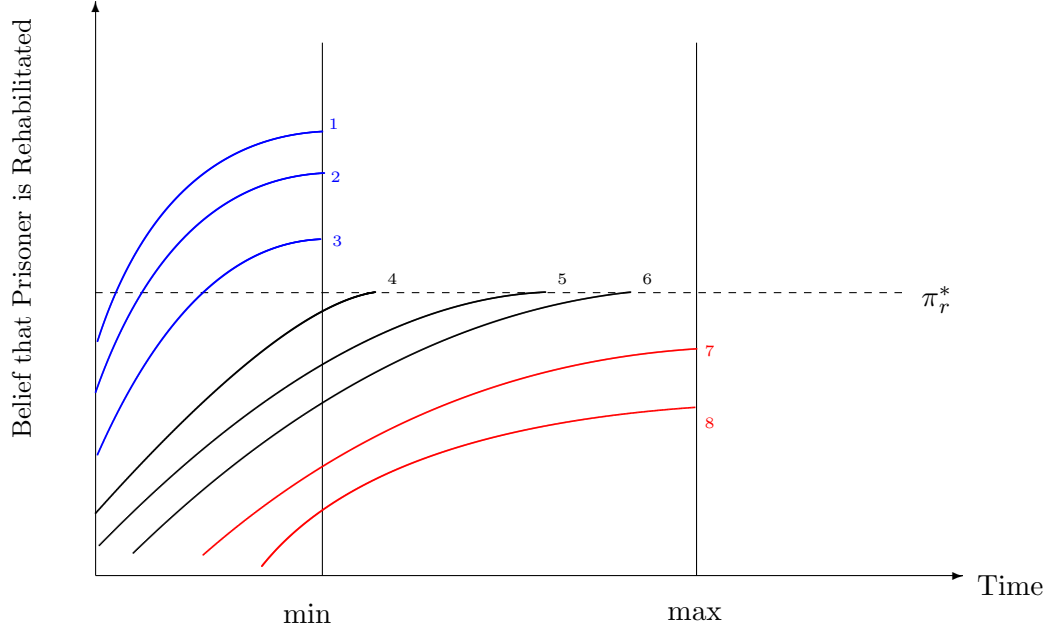


Figure 1: A Graphical Illustration of the Parole Board's Release Decisions.

nonrehabilitated inmate will have no incidents during time interval Δ with probability $e^{-\lambda r_i \Delta}$, we have:

$$\pi_{t+\Delta}^i = \frac{\pi_t^i}{\pi_t^i + (1 - \pi_t^i) e^{-\lambda r_i \Delta}}.$$

Thus, the evolution of the Parole Board's posterior belief if no incidents have occurred through $t + \Delta$ is governed by the following differential equation:

$$\begin{aligned} \dot{\pi}_t^i &= \lim_{\Delta \rightarrow 0} \frac{\pi_{t+\Delta}^i - \pi_t^i}{\Delta} \\ &= \lim_{\Delta \rightarrow 0} \frac{\pi_t^i (1 - \pi_t^i)}{\pi_t^i + (1 - \pi_t^i) e^{-\lambda r_i \Delta}} \frac{(1 - e^{-\lambda r_i \Delta})}{\Delta} \\ &= \lambda r_i \pi_t^i (1 - \pi_t^i). \end{aligned} \quad (2)$$

Note that $\dot{\pi}_t^i > 0$, which means each time period in which prisoner i doesn't have an incident increases the Parole Board's probability assessment that prisoner i is rehabilitated. This corresponds to the evolution of beliefs for prisoners 4-8 being drawn as upward sloping.

If inmate i has not been involved in any incident from \underline{T} up through time t , then we solve the differential equation (2) to find an expression for π_t^i :

$$\pi_t^i = \frac{1}{1 + \frac{1 - \pi_{\underline{T}}^i}{\pi_{\underline{T}}^i} e^{-\lambda r_i t}} \quad (3)$$

Proposition 2. (Parole Board's Belief Evolution) *If the Parole Board's initial belief that inmate i is of rehabilitated type is $\pi_{\underline{T}}^i$, and the inmate is not involved in any incident from time \underline{T} to time t , then the Parole Board's posterior belief at t is given by (3).*

As stated in Proposition 1, the Parole Board will want to release prisoner i the moment π_t^i hits π_r^* . We can find this optimal release time, denoted t_i^* , by equating π_t^i with π_r^* and solving out for t :

$$t_i^* \left(\pi_{\underline{T}}^i \right) = \frac{\ln\left(\frac{1-\pi_{\underline{T}}^i}{\pi_{\underline{T}}^i}\right) - \ln\left(\frac{1-\pi_{r_i}^*}{\pi_{r_i}^*}\right)}{\lambda_{r_i}}. \quad (4)$$

If this point in time occurs after the prisoner's maximum sentence \bar{T} , the Parole Board will be constrained to release them upon completion of \bar{T} . This is the case for prisoners 7 and 8 in Figure 1. If this point in time occurs between the prisoner's minimum and maximum sentences, as is the case for prisoners 4-6, the Parole Board will release them exactly at $t_i^* \left(\pi_{\underline{T}}^i \right)$. The following proposition summarizes the Parole Board's release decisions:

Proposition 3. (*Characterization of the Release Time*) *Let the Parole Board's initial belief about race- r inmate i being of rehabilitated type be $\pi_{\underline{T}}^i$. Assuming inmate i has no incidents in prison after \underline{T} , the Parole Board's release schedule is as follows:*

- If $\pi_{\underline{T}}^i \geq \pi_r^*$, inmate i is released at \underline{T} .
- If $\pi_{\underline{T}}^i < \pi_r^*$ and $\underline{T} < t_i^* \left(\pi_{\underline{T}}^i \right) < \bar{T}$, inmate i is released at $t_i^* \left(\pi_{\underline{T}}^i \right)$.
- If $\pi_{\underline{T}}^i < \pi_r^*$ and $t_i^* \left(\pi_{\underline{T}}^i \right) \geq \bar{T}$, inmate i is released at \bar{T} .

An important implication of the model is that all race- r prisoners released *between* \underline{T} and \bar{T} will have a probability of being rehabilitated that is exactly π_r^* . As is evident from Figure 1 this is not the case for those released at either \underline{T} and \bar{T} . Among race- r prisoners released at the completion of their minimum sentence, there is a substantial amount of heterogeneity in their probability of being rehabilitated at the time of their release. The same is true among race- r prisoners released at their maximum sentence.

For simplicity we have assumed that rehabilitated inmates do not commit prison incidents. However in Appendix B we show that all of the key model implications continue to hold even if we allow rehabilitated inmates to be involved in prison incidents, as long as they commit these at a rate lower than their non-rehabilitated counterparts.

Reasons for Racial Differences in Sentence Served The framework of the model also allows us to see the various reasons inmates of different races serve different proportions of their sentences. The first case we consider is a racially prejudiced Parole Board. For ease of exposition, assume for now that λ and g are the same across races. As discussed earlier, if the Parole Board is racially prejudiced against minority inmates they will require them to have a higher probability of being rehabilitated than white inmates (i.e. $\pi_M^* > \pi_W^*$). Figure 2(a) shows the effects of this on two inmates, one white and one minority, who have exactly the same characteristics (and are thus represented by the same π_t^i curve). As is evident from the figure, $t_W^* < t_M^*$, and thus the minority inmate will be forced to serve more of their sentence than the identical white inmate.

Disparities in time served can also arise from statistical discrimination, which occurs when there is crucial information that is unobservable to the Parole Board, and is correlated with inmate race. It will be

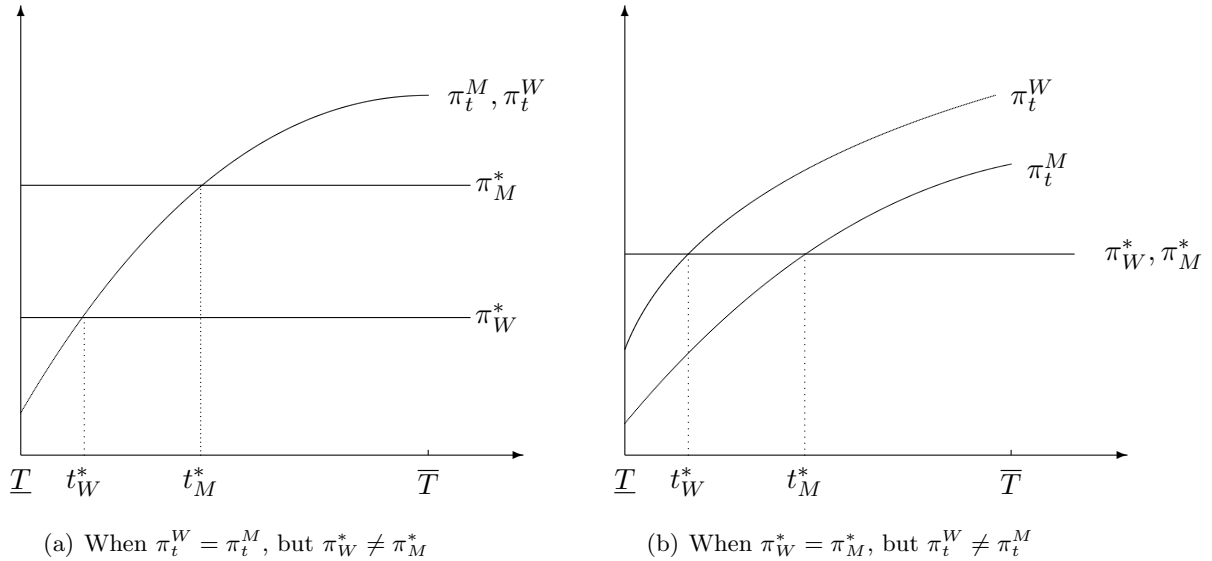


Figure 2: Reasons for Racial Differences in Sentence Served.

efficient for the Parole Board to proxy for this unobservable information by taking an inmate's race into account. If, on average, minorities are known to rate worse with respect to this unobservable information, statistical discrimination will result in the Parole Board having a lower initial probability of a minority inmate being rehabilitated than they will have of an observationally equivalent white inmate. As shown in Figure 2(b), the Parole Board will then require more incident-free time of minorities before they hit the release threshold.

If the parameters λ and g differ across races, it will be efficient for the Parole Board to take these differences into account, which will again lead to observationally equivalent individuals serving different amounts of their sentences. Because the Parole Board uses this information out of efficiency purposes (and not racial prejudice), this is another manifestation of statistical discrimination.

Finally, an omitted variables problem will also result in us observing racial differences in time served. This is different than both racial prejudice and statistical discrimination, because in both of the above cases, researchers have access to the same information the Parole Board does, but will still find racial differences in time served using a regression framework. With an omitted variables problem, we can find racial differences in time served simply because we cannot control for all of the factors the Parole Board takes into account in making release decisions.

The above analysis makes clear that a valid test for racial prejudice cannot rely on time served, because racial prejudice, statistical discrimination, and an omitted variables problem all have similar implications on time served. In the next section we will develop a test that does not have this problem.

4.2 Test for Racial Prejudice

Given the difficulty mentioned above in using the racial disparities of the parole release time as indications of racial prejudice, we instead use an outcome test. This test requires an outcome that can be identified with available data, and where taste and statistical discrimination have different impacts. If we

restrict ourselves to looking at inmates that are released between their minimum and maximum sentences, the outcome that satisfies both of these requirements is the inmate’s expected rate of recidivism on parole, defined as $(1 - \pi_r^*) g_r$. Recall that this rate is the same for everyone within a race because the Parole Board strategically releases every race- r inmate at the time their probability of being rehabilitated is exactly π_r^* .

Plugging in the expression of π_r^* from (1), we have

$$(1 - \pi_r^*) g_r = \frac{B - D_r}{C}. \quad (5)$$

Thus, the only reason the expected rate of recidivism will differ across races occurs if D differs across races, which happens if racial prejudice is present. Intuitively, with statistical discrimination, the Parole Board will take race into account when making release decisions, but they do so in such a way that the expected rate of recidivism across all races is the same. When the Parole Board is racially prejudiced against race- r inmates, they will require them to serve longer than is optimal and they will thus recidivate at a lower expected rate.

Note that the probability that parolees are rehabilitated, π_r^* , would not satisfy the outcome test requirement because both racial prejudice and statistical discrimination can lead to π_r^* differing by race. From Equation 5 we see the optimal π_r^* depends not just on prejudice but on g_r as well. Specifically, even if there is no racial prejudice, race- r members would be required to have a higher probability of being rehabilitated if their non-rehabilitated members have a higher rate of recidivating upon release. While the fact that our test relies on comparing recidivism rates as opposed to rehabilitation rates is a direct implication of the model, this result is in line with the likely incentives of the Parole Board. From the Parole Board’s perspective, two individuals who are released with the same rehabilitation probability but different rates g_r will impact them in different ways. Even though both individuals will have the same eventual likelihood of recidivating, the individual with the higher g_r (and thus the higher recidivism rate) will likely recidivate much sooner. While the recidivism cost of both individuals is the same, the Parole Board is harmed much more by the individual that recidivates right away because they essentially get no benefit from releasing them as they only avoid the cost of incarcerating them for a short time period. Thus a Parole Board that is not racially prejudiced will work to ensure that all released individuals recidivate at the same rate, because this measure takes into account not just if an individual will recidivate but when.

We cannot explicitly identify the recidivism rate in our data because this would require averaging the number of crimes an individual commits in a given release period across all members of the race. In our data we only observe whether an individual was sent back to prison for committing at least one crime, but do not observe how many total crimes they committed during that period. We can, however, indirectly estimate the rate of recidivism by exploiting the fact that this rate will positively affect the probability an individual will recidivate at least once within a given release period. Specifically, because only non-rehabilitated types will recidivate, and they will do so at Poisson arrival rate $g_{r_i} > 0$, the probability that inmate i will recidivate *at least once* within a given amount of time t_i , is:

$$(1 - \pi_{r_i}^*) [1 - e^{-g_{r_i} t_i}]. \quad (6)$$

where we refer to t_i as inmate i ’s *exposure time*.

Figure 3 graphs this expression for members of a given race who have varying exposure times t_i . The probability an individual recidivates at least once within their exposure time is positively related to their

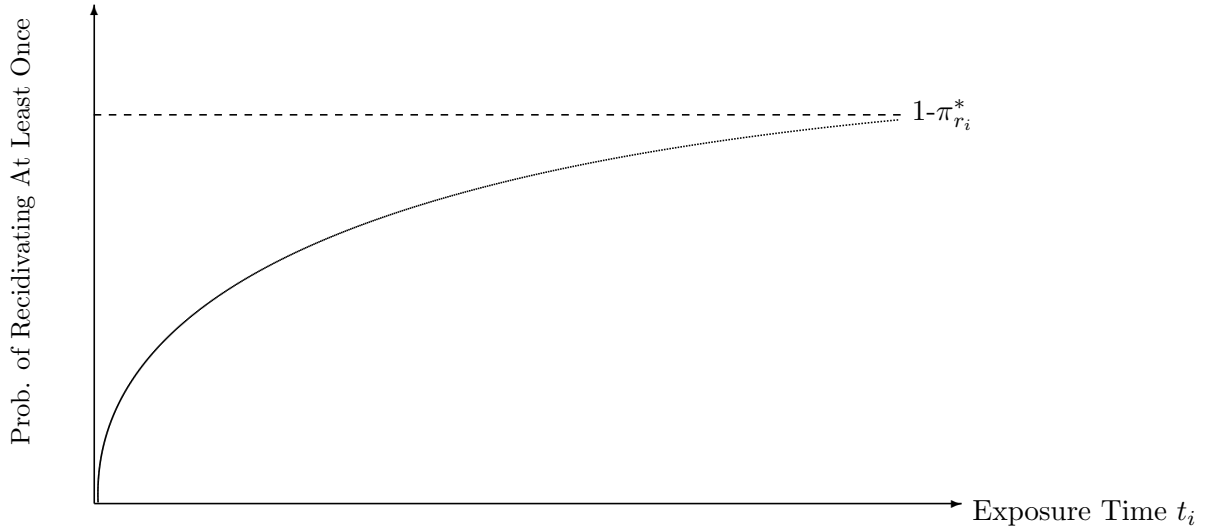


Figure 3: Probability of Race- r Parolee Recidivating At Least Once as a Function of Exposure Time.

exposure time and asymptotically approaches the proportion of race- r individuals that are not rehabilitated. Because an individual is expected to commit a certain number of crimes in a given period (defined by their rate), the longer we observe them the more likely it is they have committed at least one crime. Once we observe these individuals for a long enough time frame we would expect all non-rehabilitated individuals to have recidivated at least once; rehabilitated individuals will never recidivate, and thus the curve approaches $(1 - \pi_{r_i}^*)$.

Taking a second order Taylor series approximation of the above curve explicitly shows how the recidivism rate of race- r members affects the shape of the curve:

$$\begin{aligned}
 (1 - \pi_{r_i}^*) [1 - e^{-g_{r_i} t_i}] &\approx (1 - \pi_r^*) \{1 - [1 - g_{r_i} t_i + g_{r_i}^2 t_i^2]\} \\
 &= (1 - \pi_r^*) g_{r_i} t_i - (1 - \pi_r^*) g_{r_i}^2 t_i^2
 \end{aligned} \tag{7}$$

$$= \left(\frac{B - D_r}{C}\right) \cdot t_i - \left(\frac{B - D_r}{C} g_{r_i}\right) \cdot t_i^2 \tag{8}$$

where the last equality follows from plugging in the expression of π_r^* from (1).

Note that the coefficient on *exposure time* t_i , which measures the slope of the curve at the origin, exactly corresponds to the recidivism rate of race- r members that we are trying to identify. Intuitively it makes sense that the recidivism rate defines the slope at the origin, as this slope closely corresponds to the proportion of people expected to have recidivated at least once at the end of the first release period. All else equal, if a race of individuals is released at a higher recidivism rate, either because their members are rehabilitated at a lower rate or because their members have a higher recidivism rate conditional on being non-rehabilitated, one would expect them to have a higher fraction of individuals that recidivate

right away.²²

We can thus estimate the recidivism rate of each race by estimating (8) in a standard regression framework. Specifically, to estimate the rate for each race separately, we run the following regression:

$$\begin{aligned} \text{RECIDIVATE}_i &= \alpha_1 * t_i + \beta_1 * \text{MINORITY}_i * t_i \\ &+ \alpha_2 * t_i^2 + \beta_2 * \text{MINORITY}_i * t_i^2 + \varepsilon_i, \end{aligned} \tag{9}$$

where RECIDIVATE_i is an indicator for whether the parolee recidivates within their exposure time, and MINORITY_i is an indicator for whether inmate i is a minority.²³ The coefficient α_1 is our estimate of the expected recidivism rate for whites, while $(\alpha_1 + \beta_1)$ is the expected recidivism rate for minorities. Recall that if the Parole Board is racially prejudiced against minorities it will result in minority inmates having a lower expected recidivism rate. Thus, our test for racial prejudice will be whether $\beta_1 < 0$. Note that our test does not require us to have any observable information about the inmate except their race, their exposure time, and whether they recidivated during this exposure time.

In estimating (9) we are essentially estimating a curve similar to that shown in Figure 3 for each race. We thus need to have members of a given race which have exposure times that vary exogenously. To do this, we define exposure time as the number of months from an individual's release date from prison until January 1, 2004.²⁴ Because there should be no systematic differences between individuals released at different times, this results in similar individuals within a race having varying exposure times.

It is important to note that the only reason we can use (9) to estimate the recidivism rate for race- r inmates is because all inmates of race r are released with the same π_r . This ensures that the coefficient on t_i is race-specific, and thus can be estimated. If instead individuals within a race were released at different π 's the coefficient would be individual-specific and could not be estimated. This issue is more generally known as the infra-marginality problem and is a common problem for outcome tests. We avoid this problem because in our context the Parole Board can perfectly adjust the treatment variable (time served) to ensure that everyone has the same rate. This point highlights why our test is not valid for those who are released at their minimum or maximum sentence, since those inmates are released with various rates of rehabilitation.

Our solution to the infra-marginality problem also highlights that the core assumption we make that must be satisfied is that the Parole Board is able to release individuals at exactly t_i^* . This assumption is consistent with the way the parole process works. If individuals are turned down for parole upon completion of their minimum sentence, they are given a list of things to do and the time when they will next come up for parole. This time window is variable from inmate to inmate, and is at the complete discretion of the Parole Board. We can think of the time window the Parole Board sets for inmate i as the extra incident-free time that is needed for their perception that inmate i is rehabilitated to hit the race-specific

²²Note that although at the origin the only thing that affects the curve shape is the product of the two components of the recidivism rate $(1 - \pi_{r_i}^*)$ and g_{r_i} , as we move further away from the origin, the individual components of the rate will have distinct impacts on the shape of the curve. Specifically, at higher exposure times the race that has the higher non-rehabilitated rate will have a curve that lies above that of the race with a lower non-rehabilitated rate. Thus, because our test involves comparing the overall recidivism rate, we focus on the slope near the origin.

²³In the estimation section we will estimate this separately for blacks and Hispanics.

²⁴As will be discussed in Section 5 our data includes all individuals released from prison between 1999-2003.

threshold π_r^* . Thus, for all intents and purposes, the Parole Board is able to release every inmate at the optimum time.²⁵

4.3 Testable Implications of the Model

Because our test for prejudice comes directly from our model, it is important to run some validity checks. In this section, we delineate three implications of the model that can be directly tested. These tests will be carried out empirically in Section 6.1.

1. The first testable implication is based off (8), which is estimating the curve shown in Figure 3 separately for each race. This equation implies that the probability a race- r inmate recidivates within their exposure time is positively related to the length of their exposure time, and is negatively related to the square of their exposure time. The intuition behind the positive coefficient on exposure time was explained in the previous section. The intuition behind the negative coefficient on t_i^2 is as follows: at an exposure time of zero, the full $(1 - \pi_r^*)$ fraction of race- r individuals are eligible to recidivate. As exposure time increases and more of these individuals have recidivated, there is an increasingly smaller stock of individuals that can transition to the state of recidivating at least once. Thus we would expect the probability of recidivating at least once to increase but at a decreasing rate. Note that this equation only applies to individuals released between \underline{T} and \bar{T} , and thus we restrict the analysis to these individuals when we carry out the test.
2. The second testable implication is based off Figure 1 which implies that, within a race, all individuals released between \underline{T} and \bar{T} will recidivate at exactly the same rate. As Figure 1 shows, this implies that their recidivism rate will be independent of the fraction of the assigned sentence they serve.
3. The third testable implication is based off the probability a race- r inmate released between \underline{T} and \bar{T} recidivates within a certain time window P :

$$(1 - \pi_r^*) \left[1 - e^{-g_r(P)} \right] \tag{10}$$

This expression is similar to (6), except now the time window over which we examine the recidivism probability is the same for everyone and is not inmate specific. Recall that any race- r inmate released exactly at \underline{T} should have a rehabilitation probability π_i that is at or above π_r^* . This means the average probability of recidivating within P among all race- r inmates released at \underline{T} should be lower than the average among race- r inmates released between \underline{T} and \bar{T} (which is given by (10)). Likewise, among race- r inmates released at \bar{T} , $\pi_i \leq \pi_r^*$, implying their average probability of recidivating within P should be greater than for the group released between \underline{T} and \bar{T} . Thus we should find that the probability of recidivating within P should be in ascending order for those released immediately after serving their minimum sentences,

²⁵If individuals are turned down for parole at their next opportunity, it is usually because they have had some type of misconduct during that time window, and/or they did not complete their required programming (i.e. they have had prison incidents). With our current model, this implies that these individuals would be considered non-rehabilitated and would never be released. However, in Section B we expand our model to show that we can easily allow rehabilitated individuals to have some incidents while in prison, and thus it is possible for these individuals to eventually be released on parole.

those released in-between their minimum and maximum sentences, and those released after serving their maximum sentences.

4.4 Notes About the Model

4.4.1 Measure of Recidivism

Since we are running an outcome test based on recidivism, the biggest potential hindrance to the validity of the test would be if the Parole Board can actually affect the outcome. They would then be able to cover up racial prejudice at the parole release stage with further prejudice at the outcome stage. We measure recidivism according to the two measures most commonly used in the literature: (1) a return to prison for the commission of a new crime; and (2) a return to prison either because the individual was convicted of a new crime or a technical parole violation. Neither of these measures are likely to be affected by potential prejudice on the part of the Parole Board. The Parole Board has no direct involvement in whether an inmate is returned to prison for a new crime; the Parole Board has some input on whether an inmate will be returned to prison for a technical parole violation, but ultimately it is up to an independent hearing examiner to decide.

It should be pointed out that our recidivism measures are not completely objective in that they can still reflect prejudice on the part of other agents, such as police officers, prosecutors, judges, and parole agents.²⁶ However, if the Parole Board knows that upon the commission of a crime minorities are more likely to end up being convicted due to the discriminatory practices of other agents, they should rationally include this in their perceived rate of a non-rehabilitated race- r inmate recidivating. This is one of the reasons our model allows this rate g to depend on the race of the individual. Thus although these recidivism measures are not completely objective, so long as the Parole Board rationally takes into account any discrimination that might occur at future stages, this test will still pick up any prejudice on the part of the Parole Board.

4.4.2 Crime Controls

Up until now we have assumed that the cost to the Parole Board that results from an individual recidivating, denoted as C , is the same across all prisoners. However, the cost to the Parole Board is likely to be affected by the type of offender the individual is. Specifically, the Parole Board is likely to view recidivism by a violent offender as more costly than recidivism by a drug offender. From Equation (1) one can see that if the cost to the Parole Board from the individual recidivating is higher, they will respond by making these types of offenders have a higher probability of being rehabilitated, resulting in a lower expected rate of recidivism. Because offender type is strongly related to race, it is important to control for this when estimating (9). We break crimes out into three groups: (1) murder or sex crimes; (2) violent crimes outside of murder or sex crimes; and (3) non-violent crimes such as drug or property crimes. As noted in Section 3, the Parole Board has more stringent release procedures for the release of the first two groups of offenders, which implies there is a higher cost when these groups recidivate. Note that in order

²⁶An example of an objective outcome is the success rate of a motor vehicle search, which is used in the outcome tests examining racial prejudice in motor vehicle searches. Once a vehicle is searched, whether or not contraband is found is completely based on whether or not the individual is carrying it and is independent of the officers' behavior.

to allow different types of offenders to have different recidivism rates we need to estimate the curve shown in Figure 3 separately for these groups. This requires us to interact indicators for crime group with both exposure time and the square of exposure time.

5 Data

We use data from the Pennsylvania Department of Corrections on all individuals who were released from prison between January 1, 1999 and December 31, 2003. The data includes individuals who were released before the completion of their maximum sentence and were thus on parole from their release date until their maximum sentence expired; it also includes individuals who were released at the completion of their maximum sentence and thus spent no time on parole. We restrict the data set to individuals who were new court admissions when they first entered our data set and who were either white, black, or Hispanic males. We are left with a total of 26,343 individuals.

For each of the above individuals we observe their sentence lengths (minimum and maximum) prescribed by the judge, admission date, release date, the dates their minimum and maximum sentences are completed, name, state identification number, date of birth, and main offense committed.²⁷

We also observe each prisoner's subsequent returns to prison before March 31, 2009 (if any). We have information on the date of this return, as well as the reason for the return: whether it was for a new crime committed or a technical parole violation.

Table 2 provides some descriptive statistics of our sample both overall and stratified by race. 36% of our sample is white, 52% is black, and 13% is Hispanic. The majority of individuals released are age 45 or under. We broke the inmate's current crime into five categories: murder/sex, other violent, property, drug, and other. The type of crime individuals commit varies significantly by race: while 14% of whites commit a murder or sex crime, only 8% of blacks and 7% of Hispanics do. On the other hand, drug crimes are primarily committed by minorities. The sentence length variable shows the minimum and maximum sentences handed down by the sentencing judge. On average, individuals are given a sentence with a minimum of 34 months and a maximum of 83 months; they typically serve 48 months of their assigned sentence. Blacks tend to be assigned and serve longer sentences than both whites and Hispanics.

The release group variables indicate that 31% of the sample were released upon completion of their minimum sentence, 49% were released at some point between their minimum and maximum sentence, and 20% were not released until the completion of their maximum sentence. Here we find that whites are actually more likely than blacks or Hispanics to be required to serve their full sentence.

²⁷The date the minimum sentence is completed is often different than just the sum of the prison admission date and the minimum assigned sentence. Many individuals that cannot afford bail (or are deemed too risky) spend time in jail while they are awaiting formal sentencing, and get credit for this time served once the formal sentence is handed down. Having the date the minimum sentence is completed allows us to accurately identify individuals that are released right after serving their minimum sentence (by comparing the prison release date with the minimum sentence completion date). It also allows us to accurately calculate time served as the minimum assigned sentence plus the difference between the prison release date and the minimum sentence completion date.

6 Empirical Analysis

This section presents the results of both the tests of our model’s implications as well as our racial prejudice test. Throughout this section we define recidivism in two different ways which are consistent with the measures most commonly used in the crime literature: (1) a return to prison for the commission of a new crime; and (2) a return to prison either because of the commission of a new crime or because of a technical parole violation.

For each individual we observe the date of their most recent return for a technical parole violation and their most recent return for committing a new crime. Although we do not observe any prison returns that occur after March 31, 2009, none of our tests require us to observe recidivism beyond this date. All of the individuals in our sample are released between 1999-2003; we calculate *exposure time* as the number of months between their date of release and January 1, 2004. We then code an indicator variable for whether an individual has recidivated within this exposure time by examining whether their return to prison is before January 1, 2004.²⁸

6.1 Testing Model Implications

This section presents the results of the three model tests that were outlined in Section 4.3. These model checks should all hold within a race and so we run the tests separately by race; we also show the results for all races pooled together for completeness.

1. The first test estimates equation (8) by regressing whether an individual recidivates at least once within their exposure time on *exposure time* and *exposure time*² (without a constant). As noted in Section 4.3 the coefficients on the variables should be positive and negative, respectively, when the sample is restricted to those individuals who are released between their minimum and maximum sentence. Table 3 shows the results of these regressions for both recidivism measures.²⁹ All the coefficients have the predicted sign and all except one are statistically significant.
2. The second test checks whether the amount of an assigned sentence an offender serves is unrelated to their recidivism rate. As Figure 1 indicates, all individuals within a race released between their minimum and maximum sentence should recidivate at exactly the same rate regardless of sentence. To determine this we regress whether an individual recidivates at least once within their exposure time on *exposure time* and *exposure time*², as well as these two variables interacted with the following: actual sentence length, the assigned minimum and maximum sentence length, and indicators for whether the crime an individual committed was a murder/sex crime, or another violent crime.³⁰ This specification will essentially estimate a curve similar to that in Figure 3 for everyone

²⁸When recidivism is measured by (1), we compare the date the individual returns for committing a new crime with January 1, 2004. When recidivism is measured by (2) we compare the earliest date of return (either for a technical parole violation or new crime) with January 1, 2004.

²⁹We do not include crime controls here because they are unnecessary as crime type will not be correlated with *exposure time*. This also makes it simpler to interpret the results because for each race we are only estimating one curve; with crime controls we must estimate a separate curve for each crime type and then check all of the corresponding coefficients.

³⁰Note that crime controls are necessary here because sentence length will likely be correlated with crime type. The more

who commits the same type of crime and has the same assigned sentence.³¹ The coefficient on the interaction between exposure time and sentence length will then reveal whether the recidivism rate (and thus the resulting curve) depends on the actual sentence served. Table 4 shows the results of these regressions; for brevity we only show the key coefficients. In all but one instance the coefficient on *exposure time · Sentence Length* is statistically insignificant, implying the fraction of sentence served is unrelated to an individual’s recidivism rate.

3. The third test compares the probability of recidivating at least once within a given time period for individuals released at different points of their assigned sentence. As discussed in Section 4.3 we would expect this probability to be the lowest for individuals released right upon the completion of their minimum sentence, and the highest for individuals not released until their maximum sentence is completed. The recidivism probability for individuals released between their minimum and maximum sentence should be between these two extremes. Table 5 presents the results from regressing the likelihood of recidivating within a certain time period on indicators for when the individual was released, as well as crime controls (whose coefficients are not shown for brevity reasons). For robustness, we use two different time frames for each of our recidivism measures—namely, columns (1) and (3) correspond to whether an individual recidivates within three years upon release, and columns (2) and (4) correspond to whether an individual recidivates within five years upon release. Note that columns (3) and (4) correspond to whether an individual returns to prison within the specified time frame for either a new crime or technical parole violation. Because individuals released upon the completion of their maximum sentence mechanically cannot return to prison for a technical parole violation (since they are not released on parole) we drop these individuals and only compare recidivism probabilities among the other two groups. The constant coefficient shows the corresponding recidivism probability for those individuals released between their minimum and maximum sentence. We would expect the coefficients on the indicator for being released at the minimum sentence to be negative, and the indicator for being released at the maximum to be positive (when used). This is precisely what we find, although not all coefficients are statistically significant.

6.2 Main Result: Test for Racial Prejudice

In this section we implement the test implied by the model to determine whether there is evidence that racial prejudice plays any role in the Parole Board’s discretionary parole release decisions. Specifically, the regression results reported in Table 6 correspond to the test outlined in (9), and is run using only inmates that are released between their minimum and maximum sentences. The coefficient on *exposure time* corresponds to the recidivism rate for whites (i.e., the expected number of times a white individual would be expected to recidivate within one month). The coefficients on *exposure time · black* and *exposure time · Hispanic* reveal whether blacks and Hispanics, respectively, recidivate at a different rate than whites. Regardless of the recidivism measure used, these coefficients are always small and statistically insignificant,

severe the crime, the lower the recidivism rate an individual will be released at; on average, the Parole Board will have to keep these more severe offenders incarcerated longer to hit the lower rate. It is still the case, however, that within a crime type sentence length should have no effect on the recidivism rate

³¹Note that in order to do this any control variable must be fully interacted with both *exposure time* and *exposure time*².

implying that all racial groups are released at the same recidivism rate threshold and thus we conclude the Parole Board is not racially prejudiced in its parole release decisions.

7 Comparison with Action-Based Tests for Prejudice

As discussed in Section 2, previous studies have tested for discrimination in the parole release process by examining whether minorities either serve a greater proportion of their sentence, or are less likely to be granted parole, after controlling for various observable differences. Although these action-based tests suffer from an omitted variables problem and cannot distinguish between types of discrimination, it is still instructive to compare the results with our outcome based test results.

In Column (1) of Table 7, we report the results from regressing an inmate’s time served (measured in months) on their prescribed minimum and maximum sentences, race, age, and crime controls using the full sample of inmates. The results imply that, for a given assigned sentence, blacks serve the same amount as whites, while Hispanics serve two months less than these groups.

The tests run in Columns 2 and 3 attempt to examine the racial disparities in the Parole Board’s release decisions. For a given time period, we do not have information on the exact stock of inmates that are up for parole, nor would we observe the Parole Board’s decisions in these cases. However, as revealed in the discussion of the parole process in Section 3, all inmates go up for parole at the completion of their minimum sentence. Thus, if an inmate is not released at this stage it is a logical conclusion that the inmate was denied by the Parole Board at this stage. The specification in Column 2 regresses an indicator for whether an inmate was released at the completion of their minimum sentence on the same controls as specified previously. The results imply that the Parole Board is 2.4% points less likely to approve parole for blacks versus whites at this decision point; in contrast, Hispanics are approved at a rate similar to whites. The specification in Column 3 changes the dependent variable to an indicator for whether the inmate is released at their maximum sentence. Individuals that are initially turned down for parole will continue to go up again. If an inmate is not released until their maximum sentence is completed it implies the Parole Board has turned them down for parole several times during their period of incarceration, although we do not explicitly observe how many times this is. Here one finds that both blacks and Hispanics are actually less likely to be released at their maximum sentence than whites.

Overall, Table 7 shows the danger of using these types of action-based tests. While our test found no evidence of racial prejudice against either blacks or Hispanics, these tests provide a mixed picture. Specifically, users of the test in the first column would conclude there was no discrimination against blacks, while users of the tests in the second and third columns would conclude there was discrimination against blacks and discrimination in favor of blacks, respectively. The results from our outcome-based test imply the black indicator coefficients in Columns 2 and 3 are likely picking up the effects of omitted variables or statistical discrimination.

8 Conclusion

In this paper we develop a model of a Parole Board contemplating whether to grant parole to a prisoner who has finished serving their minimum sentence. In our model the Parole Board chooses to grant the

prisoner parole if and only if the assessed recidivism rate is at or below a threshold, with the threshold being lower for minority prisoners if the Parole Board is prejudiced against minorities. We show that when inmates complete incident-free time periods in prison, the Parole Board responds by revising downward their perception of the inmate’s rate of recidivism upon release. Because the Parole Board has complete discretion over when to release prisoners within the constraints of their minimum and maximum sentence this results in all prisoners released between these bounds being released at exactly the point where their rate of recidivism hits the optimum race-specific threshold.

Our model implies we can identify the race-specific thresholds used by simply identifying the race-specific average rate of recidivism for those individuals released between their minimum and maximum sentences. This approach is immune to the infra-marginality problem because, within these bounds, the marginal prisoner released is exactly the same as the average prisoner released. Using data on all prisoners released in Pennsylvania from 1999 to 2003 we find no evidence of racial prejudice on the part of the Parole Board.

Given that the prison release process is the last stage in the criminal justice process, the Parole Board’s actions at this stage can potentially give some indication of whether there are biases at earlier stages in the process. Although the Parole Board is constrained by the initial sentence the judge hands down, our model implies that the Board is able to achieve their optimal sentence for all individuals released between their prescribed minimum and maximum sentences. Furthermore, these sentences do not reflect racial prejudice. If we find that in order to achieve these optimal sentences minorities need to serve far less of their prescribed sentences than whites, this would imply racial biases at the sentencing stage.³² However, when we rerun the first specification in Table 7 using only these individuals we find that the Parole Board essentially requires all races to serve similar amounts of their sentences to achieve these optimal sentences. While this implies that racial prejudice may not be a key factor in prescribed sentence lengths a couple caveats should be kept in mind. First, this assumes judges also care about the eventual rate of recidivism when assigning sentence lengths; second, our results only apply to individuals released between their minimum and maximum sentences and thus cannot say anything about the fairness of sentences among those released at the extremes. This suggests that performing a more careful analysis of the role racial prejudice plays at earlier stages of the criminal justice process is a fruitful area of future research.

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³²Using our data, and controlling for coarse crime types and offender age, we find that minorities are assigned minimum and maximum sentences that are roughly 7 and 12 months higher, respectively, than the corresponding sentences for whites.

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Appendix

A Comparison with the MS Test

In Section 2 we mentioned the study done by Mechoulan and Sahuguet (henceforth MS) is the only prior work that uses an outcome test to study prejudice in the Parole Board release process. Their paper comes to a starkly different conclusion than ours—namely, they find that the Parole Board favors blacks in their release process, while we find no evidence of discrimination.³³ This appendix details the likely reason these papers reach different conclusions.

The key difference between our paper and the MS paper is that we model the incentives of the Parole Board differently and thus end up running a different test for racial prejudice. In the MS model the Parole Board aims to minimize the total number of individuals that recidivate while on parole and thus, in the absence of prejudice, all prisoners are released such that their probability of recidivating while on parole is the same. The Parole Board can accomplish this because of the mechanical relationship between recidivating on parole and time on parole—the less time an individual spends on parole, the lower the probability they will recidivate on parole. Thus when we look among the individuals that are released they will have *different* recidivism rates; however those with high recidivism rates will only be released when they have a short amount of time left on parole so that the overall likelihood of recidivating on parole is equalized across all inmates. In contrast, in our model the Parole Board compares the benefits and costs of keeping an inmate for the next period, which results in the Parole Board releasing all inmates with the *same* rate of recidivism in the absence of prejudice. Realistically, the core difference between the models is that MS assumes the Parole Board views recidivism at any time during parole to bear the same net cost; in contrast, our model assumes the Parole Board finds recidivism that comes closer to the release time to have a higher net cost than recidivism long after release. This results in MS comparing probabilities of whether individuals ever recidivate, while we compare rates which incorporate not just if an individual recidivates, but when.

The papers also differ in the data used. We use a detailed data set that is specific to prison releases in Pennsylvania. MS use data from the National Corrections Reporting Program (NCRP) which is less detailed but covers many different states; they do not report results from Pennsylvania in their study.

To determine whether we arrive at different conclusions due to the different tests run or the different data sets used, Table A1 runs the MS test on our data. Specifically, we regress the probability an inmate recidivates while on parole on an indicator for whether the inmate is black or Hispanic.³⁴ The MS paper uses two different definitions of recidivism: whether an inmate returns to prison due to the commission of a new crime (shown in Columns 1 and 2), and whether the inmate returns to prison for any reason (shown in Columns 5 and 6). While we use the first measure as well, we do not find the latter measure to be a good definition of recidivism. Our data reveals that approximately 14% of these returns include individuals who are charged with either committing a technical parole violation or a new crime, but where the charges were later dropped and they were subsequently released. It thus does not seem accurate to code these individuals as recidivating.³⁵ To see how robust the results are to the recidivism definition used, we include in Columns 3 and 4 our other definition of recidivism, which is returning to prison for either a new crime or technical parole violation. Like ours, the MS test is designed to be run on only the individuals the Parole Board releases between their minimum and maximum sentence. However the NCRP data includes all individuals released on parole and does not identify which individuals were released exactly at their minimum sentence and which individuals were released between their minimum and maximum; MS thus must include both groups of individuals in their sample. To mirror this sample specification Columns 1, 3 and 5 run the analysis on all individuals released

³³MS do not include Hispanics in their sample.

³⁴We drop individuals where we do not observe the full time period they are on parole.

³⁵There are huge racial differences in who is affected by these mistaken returns: 16% of the returns by blacks fall into this category in contrast to only 9% of the white returns.

on parole; Columns 2,4 and 6 restrict the sample to those the test was designed to be run on.

The results imply that regardless of the sample specification or recidivism measure used, the black coefficient is always positive and statistically significant. Within the MS context this result implies blacks are actually more likely to recidivate than whites on parole and thus the parole board actually favors blacks in their release decisions. Thus the key reason our papers come to different conclusions is due to the fact that we model the incentives of the Parole Board differently which results in us running different tests.

Although both models are theoretically plausible, we find the data is only consistent with our model's testable implications. Specifically, one key testable implication where our models differ is the effect of parole time on the probability of recidivism on parole. We detail in Section 4.3 that our model predicts that if we observe an individual for a longer period of time, we are more likely to observe them recidivating. Applied to the MS setting, this would mean that the longer an individual is on parole, the more likely they are to recidivate while on parole. The MS model, however, says that all individuals should have the same probability of recidivating on parole, and thus time on parole should have a zero effect on recidivism probability. In fact, in the MS model this is the strategic variable the Parole Board uses to ensure recidivism probabilities are equal—inmates that have a higher recidivism rate will be released with less time on parole so that they will (mechanically) have a lower chance of recidivating while on parole. Table A2 reruns the specifications from Table A1, except also adds in a control for months on parole to explicitly determine the relationship between parole time and the probability of recidivating on parole. Regardless of the specification used, the coefficient on parole time is always positive and strongly statistically significant which supports our model.

B Robustness of the Model to Prison Incidents for Rehabilitated Prisoners

In the basic model we assumed that only nonrehabilitated inmates would be involved in prison incidents. Now suppose that rehabilitated prisoners can also be involved in such incidents, but at a lower rate than non-rehabilitated types. Specifically, suppose that race- r inmates are involved in prison incidents with Poisson arrival rate λ_{1r} if they are non-rehabilitated, and λ_{0r} if they are rehabilitated with $\lambda_{1r} > \lambda_{0r} \geq 0$. This section shows that all of the key implications of the model will still hold.

Similarly to the derivation of the belief evolution equation (2), we can show that, if there is no occurrence of incident at time t , then the Parole Board's belief that i is rehabilitated evolves according to:

$$\dot{\pi}_t^i = (\lambda_{1r_i} - \lambda_{0r_i}) \pi_t^i (1 - \pi_t^i). \quad (\text{B1})$$

Note that (B1) coincides with (2) when $\lambda_{0r_i} = 0$.

On the other hand, if an incident occurs at time t , the Parole Board's revision of its belief about the inmate will not jump down to zero as in the basic case where $\lambda_{0r} = 0$. However, the posterior will still exhibit a discrete downward jump whose magnitude is derived as follows. Consider a short time interval between t and $t + \Delta$. If an incident occurs in the interval, then $\pi_{t+\Delta}^i$ can be obtained using Bayes' rule as:

$$\pi_{t+\Delta}^i = \frac{\pi_t^i [1 - e^{-\lambda_{0r_i} \Delta}]}{\pi_t^i [1 - e^{-\lambda_{0r_i} \Delta}] + (1 - \pi_t^i) [1 - e^{-\lambda_{1r_i} \Delta}]}.$$

Thus,

$$\begin{aligned} \lim_{\Delta \rightarrow 0} (\pi_{t+\Delta}^i - \pi_t^i) &= \lim_{\Delta \rightarrow 0} \frac{\pi_t^i (1 - \pi_t^i) (e^{-\lambda_{1r_i} \Delta} - e^{-\lambda_{0r_i} \Delta})}{\pi_t^i [1 - e^{-\lambda_{0r_i} \Delta}] + (1 - \pi_t^i) [1 - e^{-\lambda_{1r_i} \Delta}]} \\ &= \frac{(\lambda_{0r_i} - \lambda_{1r_i}) \pi_t^i (1 - \pi_t^i)}{\pi_t^i \lambda_{0r_i} + (1 - \pi_t^i) \lambda_{1r_i}}. \end{aligned} \quad (\text{B2})$$

Note that the expression (B2) implies that $\lim_{\Delta \rightarrow 0} (\pi_{t+\Delta}^i - \pi_t^i) = -\pi_t^i$ when $\lambda_{0r_i} = 0$, which coincides with our basic case where following an incident the Parole Board's posterior belief jumps down to zero.

Therefore, in this extended environment where rehabilitated inmates may also be involved in prison incidents, the Parole Board's evolution of beliefs becomes more complicated as it goes up continuously with episodes of no incidents, but exhibits a discrete downward jump following any incident. The more complicated belief evolution makes it impossible to provide an analytical expression of the release time t_i^* ($\pi_{\underline{T}}^i$) as we provided in (4); in the extended model, the release time t_i^* will not only depend on the Parole Board's initial belief $\pi_{\underline{T}}^i$ about inmate i , but also depend on the complete incident/no incident history of inmate i . Nonetheless, at whatever time t_i^* inmate i is released (if they are released at all between \underline{T}_i and \bar{T}_i), it must satisfy:

$$\pi_{t_i^*}^i = \pi_{r_i}^*$$

where $\pi_{r_i}^*$ is characterized in (1). The effect of this generalization on Figure 1 is that the time paths for the belief evolutions will stochastically exhibit discrete downward jumps. However, the key feature for our test – that prisoners who are released in between their minimum and maximum sentences are all released at the rehabilitation belief threshold π_r^* – remains valid.

Table 2: Descriptive Statistics

Variable		All	Whites	Blacks	Hispanics
Race	White	0.356	1	0	0
	Black	0.515	0	1	0
	Hispanic	0.129	0	0	1
Age at Release	18-25	0.247	0.200	0.276	0.259
	26-35	0.370	0.328	0.388	0.410
	36-45	0.257	0.301	0.231	0.239
	46-55	0.098	0.126	0.085	0.076
	56+	0.029	0.045	0.020	0.017
crime type	murder/sex	0.103	0.144	0.084	0.066
	other violent	0.286	0.260	0.332	0.176
	property	0.168	0.248	0.134	0.084
	drug	0.297	0.126	0.348	0.563
	other	0.146	0.223	0.102	0.110
Sentence Length	min sentence (months)	33.8	31.0	36.2	32.1
	max sentence (months)	82.5	78.3	86.7	77.7
	length served (months)	47.6	46.1	50.0	42.4
Released:	at min sentence	0.313	0.313	0.302	0.360
	b/w min and max sent	0.491	0.455	0.513	0.500
	at max sentence	0.197	0.233	0.189	0.141
Sample Size		26,343	9,384	13,571	3,388

Table 3: The Relationship Between Exposure Time and Recidivism

Sample	Coefficient	Commit <i>New Crime</i> w/in Exposure Time	Commit <i>New Crime</i> or <i>Parole Violation</i> w/in Exposure Time
		(1)	(2)
All (n=12,921)	Exposure Time	***0.00477 (0.00034)	***0.02322 (0.00051)
	Exposure Time ²	***-0.00002 (0.00001)	***-0.00026 (0.00001)
Whites (n=4,268)	Exposure Time	***0.00425 (0.00056)	***0.02210 (0.00088)
	Exposure Time ²	-0.00002 (0.00001)	***-0.00025 (0.00002)
Blacks (n=6,960)	Exposure Time	***0.00499 (0.00047)	***0.02410 (0.00070)
	Exposure Time ²	*-0.00002 (0.00001)	***-0.00027 (0.00001)
Hispanics (n=1,693)	Exposure Time	***0.00519 (0.00093)	***0.02227 (0.00141)
	Exposure Time ²	*-0.00003 (0.00002)	***-0.00026 (0.00003)

Notes: This table only uses the portion of the sample that were released between their minimum and maximum sentences. Exposure time is measured in months. The regressions were run using OLS without a constant; heteroskedasticity-robust standard errors are reported in parentheses.

***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Table 4: The Relationship Between Sentence Served and the Rate of Recidivism

Sample	Coefficient	Commit <i>New Crime</i> w/in Exposure Time	Commit <i>New Crime or</i> <i>Parole Violation</i> w/in Exposure Time
		(1)	(2)
All (n=12,921)	Exposure Time	***0.00579 (0.00060)	***0.02485 (0.00090)
	Exp Time *Sentence Length	-0.00002 (0.00002)	-0.00001 (0.00004)
	Exposure Time ²	*-0.00003 (0.00001)	***-0.00031 (0.0002)
	Exp Time ² * Sentence Length	0.00000 (0.00000)	0.00000 (0.00000)
Whites (n=4,268)	Exposure Time	***0.00512 (0.00101)	***0.02496 (0.00156)
	Exp Time *Sentence Length	0.00003 (0.00004)	-0.00004 (0.00007)
	Exposure Time ²	-0.00002 (0.00002)	***-0.00032 (0.00003)
	Exp Time ² * Sentence Length	-0.00000 (0.00000)	0.00000 (0.00000)
Blacks (n=6,960)	Exposure Time	***0.00591 (0.00084)	***0.02520 (0.00125)
	Exp Time *Sentence Length	-0.00003 (0.00003)	0.00004 (0.00005)
	Exposure Time ²	-0.00002 (0.00002)	***-0.00030 (0.00003)
	Exp Time ² * Sentence Length	0.00000 (0.00000)	-0.00000 (0.00000)
Hispanics (n=1,693)	Exposure Time	***0.00725 (0.00171)	***0.02611 (0.00254)
	Exp Time *Sentence Length	-0.00006 (0.00008)	*-0.00022 (0.00013)
	Exposure Time ²	-0.00005 (0.00004)	***-0.00033 (0.00006)
	Exp Time ² * Sentence Length	0.00000 (0.00000)	**0.00001 (0.00000)

Notes: This table only uses the portion of the sample that were released between their minimum and maximum sentences. Exposure time is measured in months. The regressions were run using OLS without a constant; heteroskedasticity-robust standard errors are reported in parentheses. Although the coefficients are not shown, these regressions also include controls for Exposure Time and Exposure Time² each interacted with the following variables: the assigned minimum and maximum sentence length, and indicators for whether the crime an individual committed was a murder/sex crime, or another violent crime. ***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Table 5: The Relationship Between Recidivism and when an Inmate is Released

Sample	Coefficient	Commit New Crime:		Commit New Crime or Parole Violation:	
		within 3 years (1)	within 5 years (2)	within 3 years (3)	within 5 years (4)
All (n=26,343)	Released at Minimum	***-0.024 (0.005)	***-0.034 (0.006)	***-0.040 (0.007)	***-0.040 (0.007)
	Released at Maximum	***0.031 (0.006)	***0.034 (0.007)	---	---
	Constant	***0.181 (0.004)	***0.272 (0.005)	***0.487 (0.005)	***0.546 (0.005)
Whites (n=9,384)	Released at Minimum	***-0.035 (0.008)	***-0.042 (0.010)	***-0.073 (0.012)	***-0.074 (0.012)
	Released at Maximum	*0.018 (0.009)	0.017 (0.011)	---	---
	Constant	***0.167 (0.007)	***0.252 (0.008)	***0.474 (0.000)	***0.525 (0.009)
Blacks (n=13,571)	Released at Minimum	-0.009 (0.007)	** -0.020 (0.009)	-0.015 (0.010)	*-0.018 (0.010)
	Released at Maximum	***0.030 (0.009)	***0.037 (0.010)	---	---
	Constant	***0.189 (0.006)	***0.284 (0.007)	***0.506 (0.008)	***0.572 (0.008)
Hispanics (n=3,388)	Released at Minimum	***-0.042 (0.013)	***-0.050 (0.016)	-0.024 (0.019)	-0.017 (0.019)
	Released at Maximum	***0.096 (0.022)	***0.105 (0.024)	---	---
	Constant	***0.180 (0.010)	***0.269 (0.012)	***0.452 (0.014)	***0.505 (0.014)

Notes: This table only uses the full sample. The regressions were run using OLS with a constant (inmates released between their minimum and maximum sentence are the benchmark group); heteroskedasticity-robust standard errors are reported in parentheses. Although the coefficients are not shown, these regressions also include indicator variables for whether the crime an individual committed was a murder/sex crime, or another violent crime.

***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Table 6: The Relationship Between Race and Rate of Recidivism

	Commit <i>New Crime</i> w/in Exposure Time	Commit <i>New Crime</i> or <i>Parole Violation</i> w/in Exposure Time
	(1)	(2)
Exposure Time	0.00505*** (0.000650)	0.0237*** (0.000982)
Exposure Time * Black	0.000429 (0.000730)	0.00154 (0.00113)
Exposure Time * Hispanic	0.000477 (0.00108)	-0.000623 (0.00166)
Exposure Time * Violent Crime	-0.00269*** (0.000871)	-0.00799*** (0.00161)
Exposure Time * Other Violent Crime	-0.000929 (0.000743)	-0.00117 (0.00114)
Exposure Time ²	-0.0000177 (0.0000142)	-0.000277*** (0.0000208)
Exposure Time ² * Black	0.00000544 (0.0000160)	-0.00000554 (0.0000239)
Exposure Time ² * Hispanic	-0.0000118 (0.0000234)	0.000000972 (0.0000350)
Exposure Time ² * Violent Crime	-0.00000385 (0.0000190)	0.000101*** (0.0000343)
Exposure Time ² * Other Violent Crime	-0.00000562 (0.0000162)	0.0000197 (0.0000241)
Sample	12921	12921
R-squared	0.171	0.447

Notes: This table only uses the portion of the sample that were released between their minimum and maximum sentences. Exposure time is measured in months. The regressions were run using OLS without a constant; heteroskedasticity-robust standard errors are reported in parentheses.

***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Table 7: Action-Based Tests for Racial Prejudice

	Sentence Served	Released at Minimum Sentence	Released at Maximum Sentence
	(1)	(2)	(3)
Black	-0.120 (0.237)	-0.0236*** (0.00620)	-0.0142*** (0.00526)
Hispanic	-1.975*** (0.295)	0.00675 (0.00943)	-0.0470*** (0.00711)
Minimum Sentence	0.834*** (0.0154)	0.00312*** (0.000238)	0.000282* (0.000157)
Maximum Sentence	0.0931*** (0.00668)	-0.000869*** (0.000103)	-0.00214*** (0.0000660)
Violent Crime	25.58*** (0.573)	-0.362*** (0.00758)	0.413*** (0.00974)
Other Violent Crime	6.984*** (0.249)	-0.169*** (0.00652)	0.148*** (0.00591)
Age	0.0290** (0.0113)	0.00202*** (0.000292)	0.000718*** (0.000253)
Constant	6.461*** (0.433)	0.309*** (0.0115)	0.268*** (0.0100)
Sample	26343	26343	26343
R-squared	0.801	0.060	0.122

Notes: This table uses the full sample. The regressions were run using OLS with a constant; heteroskedasticity-robust standard errors are reported in parentheses. The variables *Sentence Served*, *Minimum Sentence*, and *Maximum Sentence* are measured in months. *Age* corresponds to how old an inmate is on the date they complete their minimum sentence. ***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Appendix Table A1: The Relationship Between Race and the Likelihood of Recidivating on Parole

	Commit a <i>New Crime</i> while on Parole		Commit a <i>New Crime or Parole Violation</i> while on Parole		Return to Prison while on Parole	
	(1)	(2)	(3)	(4)	(5)	(6)
Black	0.0290*** (0.00523)	0.0183*** (0.00666)	0.0717*** (0.00798)	0.0512*** (0.0103)	0.111*** (0.00798)	0.0971*** (0.0103)
Hispanic	0.0124* (0.00752)	0.0146 (0.00973)	0.0291** (0.0115)	0.00675 (0.0150)	0.0131 (0.0115)	-0.00968 (0.0150)
Constant	0.104*** (0.00405)	0.106*** (0.00521)	0.417*** (0.00617)	0.434*** (0.00804)	0.449*** (0.00617)	0.461*** (0.00803)
Sample	All Parolees	Parolees released b/w min and max	All Parolees	Parolees released b/w min and max	All Parolees	Parolees released b/w min and max
Sample Size	18805	11412	18805	11412	18805	11412
R-Squared	0.002	0.001	0.004	0.002	0.012	0.010

Notes: This table only includes individuals where the entire time on parole is observed (i.e., parole expires before March 31, 2009). The sample "all Parolees" refers to individuals that are released either at their minimum sentence, or between their minimum and maximum sentence. The regressions were run using OLS with a constant; standard errors are reported in parentheses.

***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.

Appendix Table A2: The Relationship Between Time on Parole and the Likelihood of Recidivating on Parole

	Commit a <i>New Crime</i> while on Parole		Commit a <i>New Crime or Parole Violation</i> while on Parole		Return to Prison while on Parole	
	(1)	(2)	(3)	(4)	(5)	(6)
Black	0.0279*** (0.00520)	0.0170** (0.00662)	0.0691*** (0.00788)	0.0479*** (0.0101)	0.108*** (0.00783)	0.0929*** (0.00997)
Hispanic	0.0126* (0.00749)	0.0156 (0.00967)	0.0296*** (0.0113)	0.00936 (0.0147)	0.0137 (0.0113)	-0.00645 (0.0146)
Months on Parole	0.00149*** (0.000108)	0.00156*** (0.000129)	0.00348*** (0.000164)	0.00412*** (0.000197)	0.00438*** (0.000162)	0.00512*** (0.000195)
Constant	0.0568*** (0.00529)	0.0580*** (0.00653)	0.307*** (0.00802)	0.307*** (0.00996)	0.310*** (0.00796)	0.303*** (0.00985)
Sample	All Parolees	Parolees released b/w min and max	All Parolees	Parolees released b/w min and max	All Parolees	Parolees released b/w min and max
Sample Size	18805	11412	18805	11412	18805	11412
R-Squared	0.002	0.001	0.004	0.002	0.012	0.010

Notes: This table only includes individuals where the entire time on parole is observed (i.e., parole expires before March 31, 2009). The sample "all Parolees" refers to individuals that are released either at their minimum sentence, or between their minimum and maximum sentence. The regressions were run using OLS with a constant; standard errors are reported in parentheses.

***, ** and * denote a variable is significant at the 1%, 5%, and 10% level, respectively.