Racial Fairness in Sentencing
A Case Study of Selected Crimes in Jefferson County

for the

Racial Fairness Commission
Commonwealth of Kentucky Court of Justice

Final Report

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Executive Summary

This study reports the results of an examination of racial fairness in sentencing in Jefferson County between 1999 and 2002, focusing on cocaine possession and misdemeanor shoplifting cases. These two crimes are studied separately. For each type of crime, a two-stage modeling approach is used to analyze the incarceration decision first and then, for offenders who are incarcerated, the length of the sentence. A logistic regression model is used to determine whether African American offenders are more likely to serve time than other offenders while controlling for a variety of factors that may affect the likelihood of incarceration. An ordinary least squares regression model is then used to determine whether African American offenders serve longer sentences than others. We control for the possibility of sample selection bias in the latter model.

In addition, we apply a technique from the econometric literature to decompose the differences between the incarceration rates and sentences of African Americans and others. This method allows the group differences to be partitioned between endowment effects, on the one hand, and treatment effects, on the other hand. Endowment effects are due to the characteristics and circumstances of offenders, while treatment effects refer to how those characteristics are translated into incarceration decisions. Endowment and treatment effects are further decomposed into effects due to specific characteristics and the treatment of those characteristics. This method gives a more nuanced account of the causes of group differences than is usually provided in sentencing research.

With respect to cocaine possession, black offenders were incarcerated in 31.6% of cases, compared to 18.4% for non-black offenders. With respect to shoplifting, black offenders were incarcerated in 10.2% of cases, compared to 4.9% for non-black offenders. Thus one aim of this research is to explain the 13.2 and 5.3 percentage point differences in incarceration rates. Of those who are incarcerated for cocaine possession, the average sentence was 3.3 years (40 months) for blacks and 2.9 years (35 months) for others. In contrast, of offenders incarcerated for shoplifting, blacks received lower average sentences (10 days) than did members of other groups (15 days). Incarceration rates and sentence lengths are adjusted for suspended and conditionally discharged sentences as well as credit for time served prior to sentencing.

We seek to explain relative incarceration rates and sentence lengths using a wide range of potentially relevant variables, including: the offender's gender; whether the offender was represented by a public or private attorney; the numbers of prior felony and misdemeanor convictions; whether the offender is a persistent felony offender, first or second degree; whether the offender had any previous drug or violent crime convictions; whether the offender was on probation, parole, or conditional discharge at the time of the offense; whether any of the current charges were amended down or dismissed; the number of simultaneous felony convictions; whether any of the simultaneous convictions were for violent crimes; the age of the offender; whether the offender served time prior to sentencing; the judge responsible for sentencing; and, finally, the offender's race, defined as African American or other. Some subset of these variables was statistically significant in each of the models estimated.

We conclude that some 8.3 percentage points (63%) of the 13.2 percentage point difference in incarceration rates between blacks and others is due to treatment effects,

with the balance due to endowments. This means that it is not possible to reject the hypothesis that there is racial bias in sentencing of cocaine possession offenders in Jefferson County. The most important variable contributing to the endowment effect is the use of public attorneys, which we take as a proxy for indigence. The most important variable contributing to the treatment effect is gender: the harsher treatment of black males, although not significant in a statistical sense, has a larger quantitative impact than any other variable.

With respect to sentence lengths for those who were incarcerated for cocaine possession, we conclude that all of the 5-month difference in average sentences is due to endowments.

In the case of shoplifting, statistical tests show that, although black offenders were more likely to be incarcerated than other offenders, the difference in treatment could not be explained by the variables in the model other than the black categorical variable itself. Decomposition indicates that about 40% of the difference in incarceration rates is due to endowments and 60% is due to differences in treatment. As for cocaine possession, it is not possible to reject the hypothesis that there is racial bias in sentencing in misdemeanor shoplifting cases.

We were not particularly successful in our attempts to explain the length of sentence for incarcerated shoplifters. The adjusted R-squared statistics indicate, for example, that only 1% of the variation in sentence length for black offenders was explained by the variables in the model. Since these models do such a poor job of explaining sentence length, it would be imprudent to use them to try to decompose the endowment and treatment effects.

Introduction

Drawing on data gathered by the U.S. Census Bureau for the 2000 census, Human Rights Watch (2002) documented racial disparities in the incarceration of offenders in each state. The figures reveal that, out of a total population of 1,976,019 incarcerated in adult facilities, 63% were African American or Hispanic. In Kentucky, the rate of incarceration per 100,000 state residents is: 466 for whites, 3,375 for African Americans, and 2,059 for Hispanics. The rate of incarceration is 7.2 times higher for African Americans than for non-Hispanic whites. While 1.3% of white adult men (age 18 to 64) are incarcerated in Kentucky, 10.3% of African American adult men are behind bars in the state. Currently, African Americans represent 7.3% of Kentucky residents and 35.3% of the incarcerated population.

These statistics raise serious questions about how African Americans and Hispanics are treated at various stages of the justice administration process. This study focuses on fairness in the treatment of African Americans at the sentencing stage.[1] We do not look at fairness in detecting, arresting, or charging individuals with crimes, or in regard to what happens after sentencing, such as parole decisions.

At the direction of the Racial Fairness Commission, the focus of this study is on drug crimes and misdemeanor shoplifting. Among the various types of drug crime, only one had sufficient complete data for analysis: cocaine possession, first offense. Although we were initially directed to also undertake a study of homicides, the number of convictions for particular homicide crimes was too small to allow for statistical analysis. The convictions analyzed here are those that took place in Jefferson County between early 1999 and late 2002.

Our focus is on whether or not the offender is incarcerated and, if so, for how long. We ask the following questions regarding the relative incarceration rates of African Americans and others:

- Are African Americans more likely than other offenders to be incarcerated and, if incarcerated, to receive longer sentences for the two crimes under consideration?

- Do the characteristics of African American and other offenders differ in ways that affect relative incarceration rates and sentence lengths?

- Are African Americans treated differently from other groups when judges make decisions about sentencing? In other words, given a particular set of characteristics, are African Americans more likely to be incarcerated and to receive longer sentences?

- After controlling for the impacts of other variables, are there any judges who are more or less likely to incarcerate African Americans?

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[1] The data on ethnicity in the sentencing records are relatively incomplete and identify so few offenders as Hispanic that it was not possible to undertake an analysis of the impacts of ethnicity on incarceration.

Previous Studies of Racial and Ethnic Disparities

In an effort to discover an explanation for the disproportionate representation of racial and ethnic minorities in U.S. correctional institutions, numerous empirical studies have examined the impact of race on the sentencing of criminal offenders. However, the literature on racial disparities in sentencing is contradictory and inconsistent. As Pratt (1998) notes, empirical research has given support to the arguments that race does not play a role, plays a direct role, or has an indirect role in the sentencing process. Earlier reviews of race-sentencing studies (Hagan, 1974; Kleck, 1981) concluded that the effect of race on sentencing was largely inflated in those studies and that, when other factors were properly controlled for, the race effect was eliminated. Methodological inconsistencies—different definitions of race, differing structural contexts across jurisdictions, the absence of formal models for comparing different case dispositions, single versus multiple jurisdiction studies, or differing levels of aggregation of data—contributed to differences in research outcomes (Pratt, 1998).

More recently, in a review of 38 state-court race-sentencing studies published between 1975 and 1991, Chiricos and Crawford (1995) examined racial differences in incarceration and sentencing decisions. The authors concluded that blacks are consistently at a disadvantage in incarceration outcomes, but no consistent black disadvantage was found for sentencing decisions. Recent published studies examining the influence of race on sentencing decisions in state and federal courts appear to support the conclusion of African American disadvantage and white advantage in incarceration decisions (Albonetti, 1997; Steffensmeier and Demuth, 2000). For example, using data on sentencing practices in Pennsylvania from 1991 to 1994 and comparing sentence outcomes for white, African American, and Hispanic defendants, Steffensmeier and Demuth (2001) found that Hispanic defendants are most at risk to receive the harshest penalties, while white defendants have the lowest risk.

Previous research on sentencing in Kentucky has for the most part focused on homicide cases involving both capital and non-capital punishment. Vito and Keil (1988) and Keil and Vito (1989, 1990, 1995) conclude that capital punishment was more likely in cases in which blacks killed whites. Vito and Keil (2000) find that racial bias also exists in sentencing in non-capital murder cases. In a study of a sample of male felons incarcerated in Kentucky in 1980, Crew (1991) concludes that blacks tended to have longer sentences because they were charged with more serious crimes relative to the severity of the offense than was true for whites.

The Criminal Justice Process and Implications for the Analysis of Sentencing Decisions

Sample Selection Bias and Related Issues

Racial or ethnic discrimination in sentencing is complicated by the fact that discriminatory treatment can occur at earlier stages in the criminal justice process and that this can bias the conclusions reached from analysis of sentencing alone. Differential treatment can occur at the detection, arrest, bail, charging, and conviction stages of the process. The statistical distortions that result from the failure to include all offenders in a

sample are known as *sample selection bias*.[2] In studies of sentencing, the sample typically includes only those offenders who were convicted of a crime, excluding all offenders who weren't convicted, charged, arrested, or detected. Failure to account for the treatment of offenders who weren't convicted may distort the results obtained from analysis of those who were convicted. Generally, the impact of sample selection bias is that analyses of sentencing alone are less likely to find evidence of racial or ethnic bias than would be the case if it were possible to undertake a complete analysis of all offenders. For example, white cocaine users may be less likely to be detected and arrested than black users, suggesting that any bias found at the sentencing stage will understate the overall bias against blacks.[3]

Recent research on sentencing has introduced controls for sample selection bias that may occur within the sentencing process (e.g., Steffensmeier and Demuth, 2001). This research recognizes that sentencing is a two-stage process involving first an incarceration decision and then a decision about the length of the sentence for those who are incarcerated. Following Heckman (1979), the approach to this is to estimate a two-stage model in which the first stage is a logit (also referred to as logistic) or probit regression equation explaining the likelihood of incarceration, and the second stage is an ordinary least squares equation explaining the length of sentence for only those offenders who are incarcerated. The Heckman method uses the results from the first stage to calculate values for a new variable (referred to as an inverse Mills ratio or hazards rate) that is incorporated as an additional independent variable in the second stage equation; this new variable in effect adds a control for the probability of incarceration in the second stage equation, thereby eliminating sample selection bias that might result from limiting the second stage sample to only those offenders who are incarcerated. We apply the Heckman method in the current study.

In addition to sample selection bias, there are a number of other problems that plague sentencing research. For example, racial and ethnic bias in the process that led to prior convictions may affect current sentencing decisions (Hagan and Bumiller, 1983). Kentucky criminal law provides for penalty enhancements for persistent felony offenders.[4] African American individuals could be more likely to be subject to the persistent felony offender statute due to bias that occurred in the process that led to the prior conviction (or convictions). This is possible even if there were no additional racial bias in the process that led to the current conviction and sentence.

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[2] Note that we use the word *bias* in two distinct senses in this report. On the one hand, racial bias refers to the unfair treatment of members of one racial group relative to members of another group. On the other hand, sample selection bias refers to distortion in the results of statistical analysis due to exclusion of part of the relevant sample of individuals. See Heckman (1979) for an analysis of sample selection bias and a proposed solution to the problem. Berk (1983) provides a particularly accessible discussion of why sample selection bias is a problem with reference to a criminal justice example. See also Klepper, Nagin, and Tierney (1983).

[3] Black cocaine users may be more likely to be caught up in a "crime-and-cocaine street lifestyle" (Lockwood, Pottieger, and Inciardi, 1995, p. 231), while white users may be more likely to abuse drugs privately and less likely to simultaneously commit other crimes (the latter supposition is supported by our sample statistics on simultaneous convictions).

[4] Kentucky Revised Statutes (KRS) § 532.080.

Moreover, racial and ethnic bias is to some extent institutionalized in decisions regarding bail. Eligibility for pretrial release is evaluated using a point system that gives credit for, among other things, economic ties to the community.[5] Points are given for employment, with higher scores for longevity, as well as property ownership in Kentucky. To the extent that African Americans are less likely to have these kinds of ties, they are less likely to be eligible for pretrial release. It could be argued that bail status is a function of income, and that the lower incomes of African American offenders have nothing to do with the criminal justice system. Or, it could be argued that the justice system perpetuates or exacerbates other social biases against African Americans. Bail status is of concern because offenders who are in jail at the time of sentencing may be more likely to be further incarcerated. One way to respond to this issue is to determine whether jail time served prior to sentencing does in fact affect the probability of subsequent incarceration. If so, then any bias built into pretrial release decisions is leading to bias in subsequent incarceration decisions.

One problem associated with the analysis of specific crimes as distinct from groups of crimes is that charges are often amended or dismissed in the process of plea bargaining. Thus a drug trafficking charge may be amended down to a possession charge. The decision to amend or dismiss charges may itself be subject to racial or ethnic bias. One approach to this problem is to analyze convictions for related types of crimes together in one model. In this approach, cocaine possession and trafficking would be analyzed together, for example.[6] However, this approach leads to other problems due to the implied assumption that the factors affecting sentencing for one type of crime are the same as those affecting sentencing for other types. Although we do not address the possibility of racial bias in decisions about amending and dismissing charges, we do include variables indicating whether charges were amended or dismissed and then we determine whether those circumstances had differing impacts for different racial or ethnic groups.

Klepper, Nagin, and Tierney (1983) suggest that mixing cases involving plea bargains with those involving trials may lead to incorrect results given that the factors affecting decisions in trials may not be the same as those that affect negotiated plea decisions. Most cases do involve plea bargains due to the fact that criminal justice systems simply do not have the resources to try more than a small fraction of all cases. With respect to cocaine possession in Jefferson County, only 8 out of our sample of 833 cases actually went to trial; with respect to shoplifting, only 2 out of 1,661 cases went to trial. Consequently, we have omitted the trial cases from our analysis.

It perhaps goes without saying that analyses of the sentencing stage of the criminal justice process say nothing about possible racial or ethnic bias that may occur in subsequent stages. Decisions on appeal or about shock probation or parole are also relevant to an overall assessment of racial and ethnic bias.[7]

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[5] The pretrial services agency uses the point system to evaluate eligibility and serve as the basis for a recommendation to the court; see Kentucky Rules of Criminal Procedure (RCr) Rule 4.06.
[6] Indeed, much of the empirical research on criminal sentencing combines many different related and unrelated offenses in one model. Steffensmeier and Demuth (2001) is a good example of this approach.
[7] Shock probation is a form of suspended sentence that is granted after incarceration (see KRS § 439.265).

The current study focuses on racial bias in sentencing in a large, urban jurisdiction. It has been suggested by, for example, Hagan and Bumiller (1983) that racial discrimination is least likely to occur in such jurisdictions because (p. 32): "these court settings may be too important symbolically and too bureaucratic organizationally to allow overt discrimination as a frequent occurrence." On the other hand, some studies (see the summary in Chiricos and Crawford, 1995) have found that racial bias is more likely to occur in the South, of which Kentucky is a part.

Modeling the Sentencing Process in Kentucky

Kentucky has two levels of trial courts.[8] Circuit courts have jurisdiction over felonies, while district courts handle misdemeanors. For the purposes of the current study, this means that the cocaine possession cases were decided in circuit court, while the shoplifting cases were normally decided in district court (shoplifting cases could be decided in circuit court if other charges within the jurisdiction of that court were also included in the case). District court cases are handled at a relatively fast pace, which means that the decisions tend to be fairly routine. For Class A misdemeanor offenses, such as shoplifting, the penalty can range from 0 to 12 months, but sentences tend to be at the lower end of that range.[9] Circuit courts tend to be more deliberative, which is appropriate given the greater range and possible severity of penalties involved. Cocaine possession is a Class D felony, punishable by 1 to 5 years in prison.[10] Trial judges are authorized to sentence Class D felony offenders to sentences of 1 year or less after guilty pleas.[11] In addition, courts have the discretion to void conviction for first offenders of the possession of controlled substance statute who enter and successfully complete an approved treatment program.[12] Given the different penalties for shoplifting and cocaine possession and the likelihood that different factors affect sentencing for the two types of crime, we analyze each separately.

Felony penalties are enhanced for persons who were previously convicted of one or more felonies, are older than 21, and meet certain other requirements.[13] A person who was previously convicted of one felony is classified as a persistent felony offender in the second degree, while a person previously convicted of two or more felonies is classified as a persistent felony offender in the first degree. For a persistent felony offender in the second degree currently standing convicted of cocaine possession, the penalty is enhanced to 5 to 10 years in prison, which is the range for a Class C felony. Persistent felony offenders in the first degree have their cocaine possession penalties enhanced to 10 to 20 years, which is the range for a Class B felony.[14] Given the impact that violation

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[8] See Administrative Office of the Courts (2000) for an overview of Kentucky's court system.

[9] Misdemeanor penalties are set by KRS § 532.090.

[10] Felony penalties are set by KRS § 532.060. Kentucky law does not distinguish between crack, powder, or other forms of cocaine (KRS § 218A.1415).

[11] This is based on the Court of Appeals' interpretation of KRS § 532.070 in Commonwealth v. Doughty, 869 S.W.2d 53 (Ky. App. 1994).

[12] KRS § 218A.275.

[13] See KRS § 532.080 for details.

[14] KRS § 218A.1415 provides for enhancement of the penalty for possession of controlled substance in the first degree for second or subsequent offenses (the penalty is enhanced to that applicable to Class C

of the persistent felony offender statute can have on sentencing (both the likelihood of incarceration and sentence length), we include variables for first- and second-degree offenders in the cocaine possession models. We also test for the possible impact of the numbers of prior felonies in cocaine possession cases and both felonies and misdemeanors in shoplifting cases. We further test for the possible impact of violent criminal history on sentencing, as judges may be more severe with offenders who have a history of violent crime.

We also expect that judges should be more likely to incarcerate offenders who were on probation, parole, or conditional discharge at the time of the offense. We control for the impact of these circumstances in cocaine possession cases.

Bail status is another factor that may play a role in sentencing decisions. Bail is set by judges on the recommendation of the pretrial services agency. As noted above, a point system is used as the basis for the decision. Points are added for residency in Kentucky and personal and economic ties to the state, and subtracted for previous criminal record. The pretrial services agency also determines whether the defendant is indigent and eligible for publicly funded counsel.[15] Bail status and defense counsel are two ways that the offender's income level affect sentencing outcomes (Clarke and Koch, 1976). We control for the impacts of both of these variables on incarceration and sentence length.

The plea bargaining process often involves the dismissal or amendment of charges. For example, a guilty plea on a cocaine possession charge may involve the dismissal of persistent felony offender charges or the amendment down of a cocaine trafficking charge.[16] In cases involving dismissed and amended charges it would seem that the likelihood of incarceration would be greater and/or the length of sentence longer than in other cases. Thus we test for the possible impacts of dismissed and amended charges in both the incarceration and sentence length models for cocaine possession.

Convictions for other charges in the same case may also affect the likelihood of incarceration and sentence length. We test for the impacts of other felony convictions of any sort as well as other convictions for violent crimes.

Previous research has suggested that gender and age both can affect sentencing decisions (e.g., Steffensmeier, Kramer, and Streifel, 1993; Steffensmeier, Kramer, and Ulmer, 1995; and Steffensmeier, Ulmer, and Kramer, 1998). In particular, men tend to be sentenced more harshly than women and offenders in their twenties more harshly than younger and older offenders. Consequently, we control for the gender and age of the offender in both the incarceration and sentence length models.

There is also a possibility that certain judges sentence more or less harshly than other judges. Some judges may treat African Americans or other minorities more or less

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felonies). This is not relevant to the present study, however, as all of the cocaine possession cases involve first offenses.

[15] RCr Rule 4.09 and KRS § 31.120.

[16] In our sample of 825 cocaine possession cases, 285 cases involved charges that were amended and 133 involved charges that were dismissed. Of the cases with charges that were amended, 203 involved cocaine trafficking charges amended down to cocaine possession. Of the cases with dismissed charges, 64 involved dismissed persistent felony offender (both first and second degree) charges.

favorably than whites, and judges' race may be a factor in the severity of sentencing.[17] To control and test for these differences across judges, we include dummy variables for each of the judges who decided a significant number of cases in each sample. The default category includes those judges who each decided only a small number of cases. We do not control for the race of the judge, because the judges were not identified in the electronic data provided to us.[18]

Data and Methods

Data

The sentencing decisions occurred between early 1999 and late 2002 in Jefferson County District and Circuit Courts. Of the various drug crimes, we focused on cocaine possession because it had the greatest number of convictions (1,035). Complete data were available for a large majority of these convictions, as shown in Table 1. In the case of shoplifting, there were 4,232 convictions, of which only 1,601 cases had complete data. The missing data in most cases concerned whether the attorney was public or private and the judge.

Table 1. Crimes analyzed

Description	Class and level (sentence)	Uniform Offense Reporting Code	Sample size
Possession of controlled substance, 1st degree, 1st offense, cocaine	Felony D (one to five years)	42203	825
Theft by unlawful taking, shoplifting	Misdemeanor A (up to 12 months)	23039	1,599

Table 2 lists the variables used in statistical analysis of sentencing decisions. The first two variables in the table are the sentencing decisions that we seek to explain using the other variables in the list.

The race variable is dichotomous and defined to equal 1 for African American offenders and 0 for all other offenders. The vast majority of other offenders are white; thus it was not possible to further differentiate between white and other non-black offenders. The number of offenders identified as Hispanic was very small, making it impossible to analyze Hispanic offenders as a separate group.

Most of the data used for this study were taken from an electronic database maintained by the Kentucky Administrative Office of the Courts. These data include sentencing details

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[17] Steffensmeier and Britt (2001) conclude that black judges sentence more harshly than white judges in their study of sentencing in Pennsylvania courts.

[18] The protocol for this study required that the judges not be identified. This was accomplished using a double-blind coding system. To prevent possible litigation seeking to reveal the identities of the judges, the authors obtained a Certificate of Confidentiality from the U.S. Department of Health and Human Services.

regarding the charge in question as well as all concurrent convictions and charges that were amended or dismissed. The sentencing details include information about the length of the sentence and suspended or conditional sentences. Details about credit for time served were also provided. Some of these details were double-checked in a review of the paper files for the cocaine possession cases. This review also allowed us to identify those offenders who were on probation, parole, or conditional discharge at the time of the current cocaine possession offense. The review of paper files also identified more persistent felony offenders than we were able to identify using the electronic database.

Criminal history data were tabulated by hand from individual reports produced by the Administrative Office of the Courts for each offender. The criminal history reports included the numbers of felony and misdemeanor convictions in Kentucky courts. We summarized relevant information about convictions with disposition dates prior to that of the current conviction. We also double-checked the criminal history data against pre-sentencing investigation reports for each cocaine possession offender. The main benefit of this exercise was the identification of a small number of out-of-state convictions that did not appear in the Kentucky courts' criminal history reports.

Judges' names were translated into codes by the Administrative Office of the Courts before the data were provided to us. We then recoded the data for reporting purposes. To help maintain confidentiality, we do not report any statistics that might allow for the identification of particular judges. In particular, we do not report any statistics regarding the numbers of cases of each type decided by each judge or the incarceration decisions by judge and race of offender. We included a variable for a particular judge in each incarceration model only if that judge had decided at least 40 cases with a reasonable split between black and non-black offenders. Dummy variables for judges were included only in the incarceration models, as the sample sizes for the sentence length models were too small to permit the judges' coefficients to be estimated accurately.

Table 2. Variables used in analysis

Name	Description
Dependent variables	
Incarceration time	The incarceration time in years (cocaine possession) or months (shoplifting) after subtracting suspended and conditional sentences and credit for time served.
Incarceration dummy	A dummy (dichotomous) variable defined to be 1 if incarceration time is greater than zero; defined as 0 otherwise.
Independent variables	
Male	A dummy variable defined as 1 for males and 0 for females.

Table 2. Variables used in analysis (continued)

Name	Description
Public attorney	A dummy variable defined as 1 for cases involving public defenders and *pro se* defense and 0 for cases involving private attorneys or some combination of public and private.
Prior misdemeanors	The number of prior misdemeanor convictions.
Prior felonies	The number of prior felony convictions.
Persistent felony offender, second degree	A dummy variable defined as 1 for persons charged as second-degree persistent felony offenders; defined as 0 otherwise.
Persistent felony offender, first degree	A dummy variable defined as 1 for persons charged as first-degree felony offenders; defined as 0 otherwise.
Persistent felony offender	A dummy variable defined as 1 for persons charged as persistent felony offenders of either the first or second degree; defined as 0 otherwise.
Prior drug conviction	A dummy variable defined as 1 when at least one of the prior convictions was for a drug crime; defined as 0 otherwise.
Prior violent crime conviction	A dummy variable defined as 1 if convictions within the five years prior to sentencing include at least one violent crime; defined as 0 otherwise.
Probation, parole, or conditional discharge	A dummy variable defined as 1 if the offender was on probation, parole, or conditional discharge at the time of the current offense; defined as 0 otherwise.
Amended down	A dummy variable defined as 1 when the at least one of the original charges was amended down; defined as 0 otherwise.
Dismissed charges	A dummy variable defined as 1 when the at least one of the original charges was dismissed; defined as 0 otherwise.
Number of simultaneous convictions	The number of simultaneous felony convictions excluding the conviction for the crime in question.
Simultaneous conviction	A dummy variable defined as 1 when there was at least one additional simultaneous felony conviction for a given offender; defined as 0 otherwise.
Simultaneous violent conviction	A dummy variable defined as 1 when there was at least one simultaneous violent felony conviction for a given offender; defined as 0 otherwise.
Age greater than 25	A dummy variable defined as 1 for offenders older than 25; defined as 0 otherwise.
Presentencing detention	A dummy variable defined as 1 for offenders who had already served time prior to sentencing (i.e., were not released on bail); defined as 0 otherwise.
Black	A dummy variable defined as 1 for African American offenders; defined as 0 otherwise.
Judge A, Judge B, etc.	A series of dummy variables defined as 1 if a given judge was responsible for sentencing; defined as 0 otherwise.

Relative incarceration rates for African American and other offenders are shown in Table 3. Incarceration rates for African Americans are higher than those for other offenders: 72% higher for cocaine possession and 108% higher for shoplifting. In the case of sentence length, however, the differences are not so great and non-black shoplifters who are incarcerated on average serve longer terms than blacks who are incarcerated. Sentence lengths are adjusted for any time already served and for suspended and conditionally discharged sentences. Black cocaine possession offenders who are incarcerated are sentenced for terms that exceed the average terms of other offenders by 14%; this translates into a 5-month difference in average sentences. For shoplifting, non-black offenders on average receive 44% longer sentences than black offenders, a gap of 5 days.

Table 3. Incarceration rates and average sentence length by race

Crime	Black offenders		Other offenders	
	Rate	Average sentence length for those serving time	Rate	Average sentence length for those serving time
Cocaine possession	31.6%	3.34 years (40 months)	18.4%	2.92 years (35 months)
Shoplifting	10.2%	0.34 months (10 days)	4.9%	0.49 months (15 days)

Note: Rates do not include cases when the only time served was prior to sentencing. Sentence length excludes conditional and suspended sentences and credit for time served and do not reflect any events taking place (such as shock probation or parole) after the time of sentencing.

Methods

The primary statistical method used is binary logistic regression analysis. This method is particularly suited to explaining phenomena that are dichotomous in nature, such as whether or not an offender is incarcerated. Regression analysis in general provides a means for considering the impacts of individual explanatory variables while controlling for the impacts of other variables. We also use ordinary least squares regression analysis (OLS), which is appropriate for explaining continuous variables. Thus we use OLS to explain the length of the sentence (after adjusting the original sentence for suspended and conditional sentences and credit for time served prior to sentencing). As noted above, we use the Heckman two-stage method for controlling for sample selection bias in the sentence length model. An inverse Mills' ratio is calculated from the first-stage logit incarceration model and then used as a variable in the second-stage OLS sentence length model. If this additional variable is statistically significant, then sample selection bias is a problem and the inverse Mills' ratio is correcting that problem.

A series of statistical tests is used to determine whether the treatment of African Americans differs significantly from the treatment of others. With respect to the incarceration models, we use a series of likelihood ratio tests and *t*-tests of structural

differences in the treatment of black and other offenders. The first likelihood ratio test compares the log likelihood for the pooled estimation that excludes the race dummy variable, L_P, with the sum of the log likelihoods for the separate racial group estimations, L_B and L_W. The first statistic, $X_1 = -2(L_P - L_B - L_W)$, tests the null hypothesis of common slopes and intercepts, and is distributed $\chi^2(k)$, where k is the number of parameters estimated.[19] If this test yields a significant result, then the intercepts and/or the slopes differ between the two racial groups. Given a significant result from the first likelihood ratio test, then a second test can be used to compare the log likelihood for the pooled estimation that includes the race dummy variable with the sum of the log likelihoods for the separate group estimations. This second statistic, $X_2 = -2(L_D - L_B - L_W)$, is used to test the null hypothesis of common slopes. In this case, L_D is the log likelihood from a pooled estimation that includes the racial group dummy variable. This test statistic is distributed $\chi^2(k-1)$. If this test rejects the hypothesis of common slopes, then a model is estimated that includes all of the original variables plus each of those variables interacted with the racial group dummy variable. Significant t-statistics on the interacted terms indicate variables for which there are significant differences in treatment between the two groups.

A similar approach is used for the sentence length models; however, because these models are estimated using OLS, the appropriate statistical tests are F-tests, commonly known as Chow tests (after Chow, 1960). In this case we obtain the residual sum of squares for the pooled estimation, RSS_P, and the residual sums of squares for each of the racial group estimations, RSS_B and RSS_W. Then the F-statistic is defined as

$$F = \frac{(RSS_P - RSS_B - RSS_W)/k}{(RSS_B + RSS_W)/(n_B + n_W - 2k)},$$

where k is defined as for the log likelihood tests and n refers to the number of cases in each group.[20] If F is statistically significant, then there are significant differences in treatment between the two groups' equations. Then a model is estimated that includes all of the original variables plus those variables interacted with the racial group dummy variable. As for the incarceration rate models, significant t-statistics on the interacted terms indicate variables for which there are significant differences in treatment between the two groups.

The final stage of the analysis involves decomposition of group mean differences into proportions defined as "endowment" and "treatment" effects. The method used for this was developed by Blinder (1973) and Oaxaca (1973) to analyze differences between men's and women's wages. It has subsequently been used in many studies in the field of labor economies, and more recently has been used in housing economics to compare the homeownership rates of African Americans, Hispanics, and whites in the U.S. (Wachter and Megbolugbe, 1992), immigrants and native-born householders in Australia (Bourassa, 1994), and Maori and residents of European descent in New Zealand

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[19] See Greene (1997, pp. 161-162) for a discussion of likelihood ratio tests.
[20] See Gujarati (1995, pp. 262-265) for a simple explanation of this statistic.

(Bourassa, 2002). Our review of the literature suggests that this technique has not been used before in criminal justice studies.

The decomposition involves calculating a hypothetical incarceration rate or average sentence length by using the parameters estimated for one group and the characteristics, or endowments, of the other group. For example, we are interested in the hypothetical incarceration rate for blacks, Γ_{HB}, if they kept their endowments but had the same parameters as whites. Given the following equality

$$\Gamma_B - \Gamma_W = \left(\Gamma_B - \Gamma_{HB}\right) + \left(\Gamma_{HB} - \Gamma_W\right),$$

the difference between the incarceration rates of whites and blacks, $\Gamma_B - \Gamma_W$, can be decomposed into a treatment effect, $\Gamma_B - \Gamma_{HB}$, where the parameters (treatment) change and the endowments remain the same, and an endowment effect, $\Gamma_{HB} - \Gamma_W$, where the parameters remain constant and the endowments change.[21] It should be noted that the decomposition into endowment and treatment effects depends on which group's parameters are used to calculate the hypothetical outcome. This equation assumes that the non-black group's parameters are used as the basis for comparison. We deal with this by calculating the hypothetical rate both ways and then averaging the results.

The hypothetical incarceration rate, Γ_{HB}, is calculated as follows. After estimating the model for the sample of white offenders, the parameters estimated for that model are used together with the data for the African American sample:

$$\Gamma_{HB} = \left(\sum_{n_B} \Lambda\left(\beta_W x_B\right)\right) \Big/ n_B,$$

where: $\Lambda(\cdot)$ is the logistic cumulative density function, $\exp(\cdot)/(1 + \exp(\cdot))$; β_W is the vector of parameters estimated for the white sample; x_B is the matrix of characteristics or variable values for the black sample; and n_B is the number of offenders in the black sample. The hypothetical mean sentence length is calculated in an analogous manner, but does not involve the logistic cumulative density function (because the estimation method is OLS rather than logit).

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[21] In the economics literature, what we refer to here as the "treatment" effect is typically referred to as the "residual" effect, which is that part of the difference in group means that is not explained by the endowments included in the model. In the housing tenure choice literature, for example, some of the differences in parameters across groups may be due to the choices of members of those groups rather than to differential treatment. In regard to criminal sentencing, however, the term "treatment" seems generally appropriate. An important qualifier is that the residual or treatment effect contains the impacts of relevant endowments not included in the model. This suggests that the decomposition technique could overstate the treatment effect if significant endowments are omitted from the model. On the other hand, as noted previously, some of the endowments themselves may be the results of unfair treatment, suggesting that the treatment effect may be understated.

Further analysis can assess the relative contributions of different characteristics to the endowment effect and of different parameters to the treatment effect. Decomposition of the endowment effect permits identification of the relative importance of different offender characteristics. The relative impact of a given variable is calculated using the marginal effects of each variable, computed at their group means. Note that, in the case of the logit models, the marginal effects are *not* the estimated logit coefficients.[22] The percentage impact of each endowment is

$$100\left(\delta_{x_jW}\bar{x}_{jB} - \delta_{x_jW}\bar{x}_{jW}\right)\Big/\left(\sum_{j=1}^{k}\delta_{x_jW}\bar{x}_{jB} - \sum_{j=1}^{k}\delta_{x_jW}\bar{x}_{jW}\right),$$

where δ_{x_jW} is the marginal effect for independent variable j in the relevant equation estimated for the non-black sample and $\bar{x}_{jB}$ and $\bar{x}_{jW}$ are the means for variable j in the black and non-black samples, respectively. In the case of the treatment effect, the relative contributions of each parameter are calculated as follows:

$$100\left(\delta_{x_jB}\bar{x}_{jB} - \delta_{x_jW}\bar{x}_{jB}\right)\Big/\left(\sum_{j=1}^{k}\delta_{x_jB}\bar{x}_{jB} - \sum_{j=1}^{k}\delta_{x_jW}\bar{x}_{jB}\right),$$

where δ_{x_jB} is the marginal effect for independent variable j in the relevant equation estimated for the black sample and the other terms are defined as before. These two calculations are used to identify the variables that have the greatest impacts on the endowment and treatment effects. Note that the results of the calculations depend on which group is chosen as the basis for comparison. These equations assume that the non-black group is the basis for comparison. As for the decomposition into endowment and treatment effects, we deal with this potential problem by also performing the calculations as if the black group were the basis for comparison and then we average the two sets of results.

Detailed Results for Cocaine Possession

Tables 4 and 5 give the sample means for the data used for the incarceration and sentence length models for cocaine possession. Sample means are given only for the variables that were statistically significant in one or more of the models estimated. As noted above, we do not list means for the judge dummy variables even though these were included in the incarceration models. Table 4 shows that black cocaine possession offenders are more likely to be male, to use public attorneys, to have prior convictions for violent crimes, to

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[22] For a discussion of the calculation of marginal effects for logit models, see Greene (2002), section R10.4.

have been on probation or parole or conditional discharge, to have dismissed charges, and to have simultaneous convictions.

Table 4. Sample means, cocaine possession, incarceration model

Variable	Black	Other	Pooled
Dependent variable:			
Incarcerated	0.32	0.18	0.28
Independent variables:			
Male	0.84	0.75	0.82
Public attorney	0.46	0.22	0.41
Persistent felony offender	0.12	0.12	0.12
Prior violent crime conviction	0.03	0.01	0.02
Probation, parole, or conditional discharge (at time of offense)	0.25	0.16	0.23
Dismissed charges	0.18	0.09	0.16
Simultaneous conviction	0.40	0.31	0.38
Summary statistics:			
Sample size	624	201	825
Percent of total sample	75.6%	24.4%	100.0%

Table 5. Sample means, cocaine possession, sentence length model

Variable	Black	Other	Pooled
Dependent variable:			
Incarceration time in years	3.34	2.92	3.27
Independent variables:			
Male	0.89	0.76	0.87
Persistent felony offender, first degree	0.07	0.05	0.07
Persistent felony offender, second degree	0.15	0.16	0.15
Probation, parole, or conditional discharge (at time of offense)	0.34	0.19	0.31
Number of simultaneous convictions	0.09	1.46	0.02
Amended down	0.38	0.30	0.36
Summary statistics:			
Sample size	197	37	234
Percent of total sample	84.2%	15.8%	100.0%

Table 6 gives the results of the incarceration regression for the two racial groups. Both degrees of persistent felony offender were combined into a single variable because initial

estimations showed that the coefficients for the separate variables were virtually the same. Of black offenders, those who were male, used public attorneys, were persistent felony offenders, had prior convictions for violent crimes, had simultaneous convictions, were on probation or parole or condition discharge at the time of the offense, and who had dismissed charges were more likely to be incarcerated. For non-black offenders, use of a public attorney and persistent felony offender status resulted in greater likelihood of incarceration, while sentencing by Judge E resulted in a lower likelihood of incarceration.

Table 6. Results for logistic incarceration regression, separate group estimations, cocaine possession

Variable	Black offenders		Other offenders	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-1.911	0.367***	-1.727	0.659***
Male	0.552	0.279**	-0.301	0.499
Public attorney	0.321	0.190*	1.402	0.515***
Persistent felony offender	1.282	0.285***	1.393	0.626**
Prior violent crime conviction	1.501	0.588**	2.342	1.426
Probation, parole, or conditional discharge (at time of offense)	0.403	0.217*	0.020	0.573
Simultaneous conviction	0.529	0.190***	-0.435	0.471
Dismissed charges	0.678	0.228***	-1.010	0.845
Judge A	0.256	0.421	-1.812	1.210
Judge B	-0.351	0.382	-0.361	0.951
Judge C	-0.378	0.399	0.047	0.796
Judge D	-0.294	0.404	0.551	0.799
Judge E	-0.418	0.362	-2.080	1.169*
Judge F	-0.744	0.483	0.420	1.307
Judge G	0.620	0.397	0.971	0.805
Judge H	-0.029	0.406	-0.772	1.189
Judge I	-0.001	0.387	1.306	0.800
Judge J	-0.334	0.454	1.228	0.835
Judge K	-0.762	0.464	-0.724	1.106
Model statistics:				
Log likelihood	-347.2		-78.8	
Likelihood ratio test of β = 0	Prob < 0.0001		Prob < 0.0001	
Percent correct predictions	71.6%		83.1%	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 7 gives the results for the pooled samples. In these equations, all of the variables other than the dummy variables for judges are statistically significant. Of the judges, Judge E is significantly less likely and Judge G is significantly more likely to incarcerate than the other judges. The black categorical variable is also statistically significant with a positive coefficient in the model that includes that variable. The likelihood ratio test comparing the pooled equation with the two group equations yields a test statistic (X_1) that is significant at the 5% level, indicating that the intercepts and/or slopes of the two groups' equations differ (see Table 8). However, the test statistic (X_2) that compares the

pooled equation including the black categorical variable with the two group equations is not quite significant at the 10% level. Given that this statistic is only marginally insignificant, it is probably worthwhile to examine a pooled equation that includes a full set of variables interacted with the black dummy variable; this equation will identify significant differences in estimated coefficients between the two groups.

Table 7. Results for logistic incarceration regression, pooled estimations, cocaine possession

Variable	Pooled		Pooled with dummy	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-1.952	0.311***	-2.284	0.344***
Male	0.430	0.233*	0.374	0.235
Public attorney	0.483	0.169***	0.396	0.173**
Persistent felony offender	1.222	0.247***	1.239	0.249***
Prior violent crime conviction	1.719	0.528***	1.707	0.528***
Probation, parole, or conditional discharge (at time of offense)	0.378	0.196*	0.349	0.197*
Simultaneous conviction	0.420	0.171**	0.407	0.171**
Dismissed charges	0.648	0.211***	0.596	0.213***
Judge A	-0.125	0.376	-0.071	0.378
Judge B	-0.270	0.348	-0.286	0.350
Judge C	-0.246	0.350	-0.235	0.352
Judge D	-0.148	0.355	-0.135	0.357
Judge E	-0.604	0.329*	-0.578	0.331*
Judge F	-0.599	0.449	-0.651	0.449
Judge G	0.637	0.347*	0.674	0.350*
Judge H	-0.075	0.373	-0.090	0.374
Judge I	0.159	0.337	-0.204	0.338
Judge J	-0.017	0.390	-0.014	0.390
Judge K	-0.680	0.421	-0.671	0.421
Black			0.540	0.220**
Model statistics:				
Log likelihood	-442.6		-439.5	
Likelihood ratio test of β = 0	Prob < 0.0001		Prob < 0.0001	
Percent correct predictions	73.7%		73.8%	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 8. Statistical analysis of group differences in incarceration rates, cocaine possession

L_W = log likelihood for non-black group	-78.81
L_B = log likelihood for black group	-347.17
L_P = log likelihood for pooled estimation	-442.62
L_D = log likelihood for pooled estimation with group dummy	-439.45
X_I = χ^2 test statistic for null hypothesis of common intercepts and slopes = $-2(L_P - L_W - L_B)$	33.27
X_2 = χ^2 test statistic for null hypothesis of common slopes, given that slopes and/or intercepts are different = $-2(L_D - L_W - L_B)$	26.94
k = degrees of freedom	19
Probability for X_1	0.022
Probability for X_2	0.106

The results for the pooled equation with interacted terms are shown in Table 9. The left-hand set of results is identical to the results for the non-black equation shown in the right-hand part of Table 6. The right-hand side of Table 8 gives the differences between the estimates for the non-black group and the black group. Notably, blacks using public defenders are less likely to be incarcerated than non-blacks using public defenders, all else equal, and blacks with simultaneous convictions or dismissed charges are more likely to be incarcerated than non-blacks.

Decomposition of these results into endowment and treatment effects suggests that some 8.3 percentage points of the 13.2 percentage point difference in incarceration rates is due to treatment effects, with the balance due to endowments. In other words, about 37% of the difference in incarceration rates is due to differences in endowments and 63% is due to differences in treatment. The main contributor to the endowment effect is the use of public attorneys, which black offenders rely upon to a much greater extent than do other offenders. The main contributor to the treatment effect is the harsher sentencing of black males; although the gender coefficients for the black and non-black models do not differ in a statistical sense, the difference in coefficients has a substantial quantitative impact. As shown in Table 6, the estimated coefficient for black offenders is positive (and statistically significant), while that for other offenders is negative (although not statistically significant). Simultaneous convictions and dismissed charges are also important contributors to the treatment effect. The use of public attorneys, however, offsets some of the differential treatment of blacks. Given that the use of public attorneys is an indicator of poverty, another way to interpret this result is to say that poverty is less of a penalty in the sentencing process for blacks than it is for others. This may reflect differences in the distribution of incomes for the two groups.

Table 9. Results for logistic incarceration regression, fully interacted estimation, cocaine possession

Variable	Original variables		Interacted variables	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-1.727	0.659***	-0.185	0.754
Male	-0.301	0.499	0.854	0.572
Public attorney	1.402	0.515***	-1.080	0.549**
Persistent felony offender	1.393	0.626**	-0.112	0.688
Prior violent crime conviction	2.342	1.426	-0.841	1.542
Probation, parole, or conditional discharge (at time of offense)	0.020	0.573	0.383	0.613
Simultaneous conviction	-0.435	0.471	0.965	0.508*
Dismissed charges	-1.010	0.845	1.688	0.875*
Judge A	-1.812	1.210	2.068	1.281
Judge B	-0.361	0.951	0.010	1.025
Judge C	-0.047	0.796	-0.425	0.890
Judge D	0.551	0.799	-0.845	0.895
Judge E	-2.080	1.169*	1.662	1.224
Judge F	0.420	1.307	-1.164	1.393
Judge G	0.971	0.805	-0.352	0.897
Judge H	-0.772	1.189	0.743	1.256
Judge I	1.306	0.800	-1.307	0.889
Judge J	1.228	0.835	-1.561	0.950
Judge K	-0.724	1.106	-0.038	1.200

Model statistics:
Log likelihood   -426.0
Likelihood ratio test of β = 0   Prob < 0.0001
Percent correct predictions   74.4%

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively. Interacted variables are multiplied by the Black categorical variable.

Results for the analysis of sentence length are given in Tables 10 through 13. The results of Heckman's two-stage procedure indicate that the sample selection correction variable, λ, is statistically significant in most of the estimations.[23] Thus we retained λ to control for selection bias. Note that we specified the number of simultaneous felony convictions in logarithmic terms based on our assumption that the impact of additional convictions tends to diminish as the number increases.

It is interesting to note that the dummy variable for amended charges is significant in the sentence length model but not the incarceration model, while the variable for dismissed charges is significant in the incarceration model but not the sentence length model. Amended charges add about 6 months on average to sentence length for black offenders compared with 11.5 months for other offenders. As would be expected, in the sentence length model we separate out the two degrees of persistent felony offender. For black second degree persistent felony offenders, sentences average about 2 years and 2 months

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[23] Note that when λ is significant, it has a negative coefficient, which is expected because it has an inverse relationship to the probability of incarceration.

longer, and for first degree persistent felony offenders, they average about 4 years and 10 months longer. For non-black persistent felony offenders, the additional penalties are 2 years and 3 months and 8 years, respectively. The probation, parole, or conditional discharge variable is significant only for black offenders, who receive about 7.5 months' additional sentence for having one of those characteristics. Gender, on the other hand, appears to be significant only for the non-black sample, with males in that group receiving an almost 17-month penalty relative to females.

Table 10. Results for ordinary least squares sentence length regression, separate group estimations, cocaine possession

Variable	Black offenders		Other offenders	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	3.109	1.144***	0.650	1.255
Male	0.296	0.510	1.384	0.691*
Persistent felony offender, first degree	4.841	0.648***	8.009	1.230***
Persistent felony offender, second degree	2.191	0.532***	2.250	0.843**
Probation, parole, or conditional discharge (at time of offense)	0.631	0.355*	-0.888	0.638
Log of number of simultaneous convictions	0.343	0.380	0.202	0.389
Amended down	0.523	0.335	0.957	0.564
λ	-1.280	0.700*	0.187	0.735
Model statistics:				
R-squared	0.45		0.77	
Adjusted R-squared	0.43		0.71	
F test of β = 0	Prob < 0.0001		Prob < 0.0001	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Results for the pooled samples are shown in Table 11. The main point to note here is that the black categorical variable is not statistically significant in the equation that includes that variable. Table 12 shows the results of the Chow test of structural stability across the black and non-black equations. The *F*-statistic is insignificant, indicating that the two equations are essentially the same. These results suggest that all of the difference in sentence length between blacks and others is due to endowments. Our results are generally consistent with previous research, which has more often found racial bias in the incarceration decision than in the sentence length decision.

Table 11. Results for ordinary least squares sentence length regression, pooled estimations, cocaine possession

Variable	Pooled		Pooled with dummy	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	2.357	0.828***	2.377	0.905***
Male	0.530	0.422	0.532	0.421
Persistent felony offender, first degree	5.302	0.576***	5.300	0.577***
Persistent felony offender, second degree	2.187	0.435***	2.184	0.436***
Probation, parole, or conditional discharge (at time of offense)	0.463	0.313	0.464	0.311
Log of number of simultaneous convictions	0.496	0.265*	0.496	0.265*
Amended down	0.701	0.292**	0.701	0.296**
λ	-0.845	0.499*	-0.849	0.503*
Black			-0.021	0.377
Model statistics:				
R-squared	0.47		0.47	
Adjusted R-squared	0.46		0.45	
F test of β = 0	Prob < 0.0001		Prob < 0.0001	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 12. Statistical analysis of structural differences in sentence length models, cocaine possession

RSS_P = residual sum of squares for pooled equation	901.94
RSS_W = residual sum of squares for non-black group	59.19
RSS_B = residual sum of squares for black group	834.30
k = numerator degrees of freedom	8
$n - 2k$ = denominator degrees of freedom	809
F statistic = $((RSS_P - RSS_B - RSS_W)/k)/((RSS_B + RSS_W)/(n - 2k))$	0.956
Probability for F	0.4694

Detailed Results for Shoplifting

Tables 13 and 14 give sample statistics for shoplifting cases. As noted above, black offenders are about twice as likely to be incarcerated, but black offenders who are incarcerated serve shorter terms on average. Regarding the variables that were significant in the incarceration model, black offenders were more likely to use public attorneys (and therefore to be indigent), had been convicted previously of more felonies on average, were more likely to be older than 25, were more likely to have served time prior to sentencing, and were slightly more likely to have been convicted of one or more felonies at the same time as the shoplifting conviction.

Table 13. Sample means, shoplifting convictions, incarceration model

Variable	Black	Other	Pooled
Dependent variables:			
Incarcerated	0.10	0.05	0.07
Independent variables:			
Male	0.57	0.59	0.58
Public attorney	0.78	0.59	0.68
Prior felonies	0.90	0.44	0.66
Age greater than 25	0.73	0.66	0.70
Presentencing detention	0.11	0.06	0.08
Simultaneous conviction	0.08	0.05	0.06
Summary statistics:			
Sample size	765	834	1,599
Percent of total sample	47.8%	52.2%	100.0%

Table 14. Sample means, shoplifting convictions, sentence length model

Variable	Black	Other	Pooled
Dependent variables:			
Incarceration time in months	0.34	0.49	0.39
Independent variables:			
Male	0.77	0.63	0.72
Public attorney	0.90	0.68	0.82
Prior felonies	1.58	1.39	1.51
Age greater than 25	0.88	0.85	0.87
Summary statistics:			
Sample size	78	41	119
Percent of total sample	65.5%	34.4%	100.0%

The separate group estimations shown in Table 15 indicate that black males are more likely to be incarcerated than black females. Blacks who use public attorneys, are older than 25, and who have simultaneous convictions were all more likely to be incarcerated.

Non-black offenders who used public attorneys, had prior felonies, had simultaneous convictions, or were sentenced by Judge N were also more likely to be incarcerated. Contrary to expectations, blacks who served time prior to sentencing were significantly *less* likely to serve additional time (non-black offenders also have a negative, but statistically insignificant coefficient for this variable). This is probably due to the fact that shoplifting sentences tend to be very short and, therefore, relatively easy to fulfill prior to sentencing.

Table 15. Results for logistic incarceration regression, separate group estimations, shoplifting

Variable	Black offenders		Other offenders	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-4.222	0.652***	-6.092	1.148***
Male	0.816	0.298***	0.462	0.366
Public attorney	1.009	0.405**	0.615	0.372*
Prior felonies	0.057	0.042	0.243	0.075***
Age greater than 25	0.957	0.381**	1.170	0.469**
Presentencing detention	-1.917	0.662***	-1.438	1.050
Simultaneous convictions	1.404	0.320***	1.794	0.489***
Judge L	-0.412	0.549	1.059	1.160
Judge M	0.145	0.568	0.216	1.444
Judge N	0.034	0.640	2.186	1.100**
Judge O	0.039	0.485	1.084	1.096
Judge P	-1.117	0.728	0.516	1.455
Judge Q	-0.072	0.609	1.337	1.191
Judge R	-0.555	0.527	1.702	1.070
Judge S	-0.254	0.527	0.787	1.185
Model statistics:				
Log likelihood	-219.1		-138.6	
Likelihood ratio test of β = 0	Prob < 0.0001		Prob < 0.0001	
Percent correct predictions	90.7%		95.4%	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

The pooled results in Table 16 are notable primarily for the highly significant coefficient on the black categorical variable in the model that includes that variable. Table 17 provides the results of likelihood ratio tests of the differences between the pooled equations and the separate group equations. The results show that the pooled equation without the black categorical variable is significantly different from the combination of the two group equations (at the 5% level), but the pooled equation with the black categorical variable is not significantly different from the combination of the two group equations. This means that the intercept term for the two equations is different, but the slopes or coefficients of the remaining terms are collectively not significantly different. In other words, there is a significant difference in treatment of the two groups, but that difference is not accounted for by differences in the treatment of the specific characteristics included in the model. Thus we do not show the results for the model that

contains interacted terms. However, decomposition of the difference in incarceration rates indicates that about 40% of the gap is due to endowments and 60% is due to treatments.

Table 16. Results for logistic incarceration regression, pooled estimations, shoplifting

Variable	Pooled		Pooled with dummy	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-4.805	0.508***	-4.961	0.513***
Male	0.699	0.224***	0.680	0.224***
Public attorney	0.868	0.256***	0.745	0.262***
Prior felonies	0.107	0.036***	0.093	0.036**
Age greater than 25	1.148	0.292***	1.083	0.293***
Presentencing detention	-1.831	0.564***	-1.891	0.569***
Simultaneous conviction	1.585	0.263***	1.555	0.264***
Judge L	-0.148	0.477	-0.150	0.479
Judge M	0.149	0.508	0.138	0.512
Judge N	0.643	0.478	0.714	0.482
Judge O	0.226	0.422	0.242	0.424
Judge P	-0.657	0.636	-0.717	0.639
Judge Q	0.144	0.509	0.175	0.513
Judge R	0.140	0.426	0.174	0.428
Judge S	-0.063	0.464	-0.069	0.467
Black			0.580	0.216***
Model statistics:				
Log likelihood	-370.3		-366.6	
Likelihood ratio test of β = 0	Prob < 0.0001		Prob < 0.0001	
Percent correct predictions	92.9%		92.9%	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 17. Statistical analysis of group differences in incarceration rates, shoplifting

L_W = log likelihood for non-black group	-138.51
L_B = log likelihood for black group	-219.06
L_P = log likelihood for pooled estimation	-370.31
L_D = log likelihood for pooled estimation with group dummy	-366.61
$X_1 = \chi^2$ test statistic for null hypothesis of common intercepts and slopes = $-2(L_P - L_W - L_B)$	25.33
$X_2 = \chi^2$ test statistic for null hypothesis of common slopes, given that slopes and/or intercepts are different = $-2(L_D - L_W - L_B)$	17.93
k = degrees of freedom	15
Probability for X_1	0.046
Probability for X_2	0.266

Tables 18 and 19 give the results for the sentence length regressions. The sample selection correction variable, λ, was not significant in any of the shoplifting sentence length regressions and therefore was omitted from the models. Although the equation for non-black offenders has a reasonable adjusted *R*-squared of 0.31 (sentence length models typically have low *R*-squared statistics), the comparable statistics for the equation for black offenders is only 0.01, and for the pooled equations only 0.04 and 0.03. This means, for example, that the equation for black offenders explains only 1% of the variation in sentence length. Recall that the difference in average sentence length between blacks and others is only 5 days. Since these models do such a poor job of explaining sentence length, it would be imprudent to use them to try to decompose the endowment and treatment effects.

Table 18. Results for ordinary least squares regression on sentence length, separate group estimations, shoplifting

Variable	Black offenders		Other offenders	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	0.319	0.129**	0.406	0.199**
Male	0.140	0.079*	-0.119	0.116
Public attorney	0.035	0.108	-0.241	0.116**
Prior felonies	0.000	0.010	0.033	0.019*
Age greater than 25	-0.137	0.100	0.322	0.156**
Model statistics:				
R-squared	0.07		0.38	
Adjusted R-squared	0.01		0.31	
F ratio test of β = 0	Prob = 0.2814		Prob = 0.0014	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 19. Results for ordinary least squares regression on sentence length, pooled estimations, shoplifting

Variable	Pooled		Pooled with dummy	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	0.448	0.112***	0.481	0.112***
Male	-0.013	0.069	-0.002	0.068
Public attorney	-0.171	0.080**	-0.131	0.082
Prior felonies	0.013	0.010	0.013	0.010
Age greater than 25	0.082	0.091	0.091	0.090
Black			-0.127	0.064*
Model statistics:				
R-squared	0.07		0.10	
Adjusted R-squared	0.04		0.03	
F test of β = 0	Prob = 0.0804		Prob < 0.0328	

Note: ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Conclusions

We conclude that some 8.3 percentage points (63%) of the 13.2 percentage point difference in incarceration rates between blacks and others is due to treatment effects, with the balance due to endowments. This means that it is not possible to reject the hypothesis that there is racial bias in sentencing of cocaine possession offenders in Jefferson County. The most important variable contributing to the endowment effect is the use of public attorneys, which we take as a proxy for indigence. The most important variable contributing to the treatment effect is gender: the harsher treatment of black males, although not significant in a statistical sense, has a larger quantitative impact than any other variable.

With respect to sentence lengths for those who were incarcerated for cocaine possession, we conclude that all of the 5-month difference in average sentences is due to endowments.

In the case of shoplifting, statistical tests show that, although black offenders were more likely to be incarcerated than other offenders, the difference in treatment could not be explained by the variables in the model other than the black categorical variable itself. Decomposition indicates that about 40% of the difference in incarceration rates is due to endowments and 60% is due to different treatments. As for cocaine possession, it is not possible to reject the hypothesis that there is racial bias in sentencing in misdemeanor shoplifting cases.

We were not particularly successful in our attempts to explain the length of sentence for incarcerated shoplifters. The adjusted R-squared statistics indicate, for example, that only 1% of the variation in sentence length for black offenders was explained by the variables in the model. Since these models do such a poor job of explaining sentence length, it would be imprudent to use them to try to decompose the endowment and treatment effects.

Although the aim of this report was to separately model sentencing decisions for two crimes, it would be of interest in future research to model multiple felony crimes simultaneously to determine how that approach affects the results of the analysis. It would also be of interest to expand the geographical coverage of the data to include rural as well as urban areas.

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