Sentence Reductions for Drug Traffickers for Assisting Federal Prosecutors

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Summary Among convicted Federal drug traffickers sentenced in 1994, fewer blacks (34%) than whites (43%) received a reduced sentence for assisting Federal prosecutors, a disparity of 9 percentage points. Differences between the races - in types of drugs sold, in criminal histories, in weapon use, etc. - that might produce different rates of receiving sentence reductions were investigated by the United States Sentencing Commission in a multivariate statistical model (Substantial Assistance Departures in the United States Courts, draft report, chapter 8, October 1995). Surprisingly, holding constant 32 factors in the model did not reduce the size of the disparity associated with race, the model's 33rd factor. That is, after controls, the disparity was still statistically significant and still estimated at 9 percentage points. However, results reported here indicate that the 9-point disparity did not hold up upon further analysis: 1) Though the racial disparity was found to be statistically significant according to one test (the chi-square likelihood ratio test), the disparity was not found to be significant according to another (the Z-test of the difference in areas under the ROC curve); 2) Nearly 20% of the disparity disappeared when one additional relevant factor - a variable indicating whether the defendant pleaded guilty or stood trial - was added to the model; 3) Most of the factors that Federal prosecutors say influence their decision to file a substantial assistance motion were not found in the Sentencing Commission model, suggesting that the model provides an unsound basis for concluding whether the defendant's race plays a role in prosecutor decisions to seek sentence reductions.

Background Federal defendants often provide valuable assistance to prosecutors. They testify under oath against accomplices; give vital information leading to the prosecution of persons in other cases; confess to additional crimes; or actively participate in the investigation of suspects. In return for providing *substantial assistance* to the government, defendants may receive a reduced sentence. A provision in Federal law allows prosecutors, at their discretion, to file a motion asking the court to impose a reduced sentence for defendants who provide substantial assistance. If the court grants the motion, the defendant then receives a sentence below what is called for in Federal sentencing guidelines. The court may reduce the sentence to whatever extent it deems appropriate and may even impose a term below a mandatory minimum sentence established by statute.[1] To illustrate, if the guideline range is 30 to 37 months, the judge can sentence the defendant anywhere from 0 months (meaning straight probation with no confinement) to 29 months.

In actual practice, sizable reductions are awarded for providing substantial assistance. In 1994, the average sentence for defendants awarded substantial assistance reductions was nearly 3 years (33 months). Conservatively estimated, without the reductions, it would have been about 7 years (83 months) had the minimum in the guideline range been imposed. The typical reward for assisting prosecutors, then, was a sentence reduction of around 4 years (51 months), or 61% off the guideline sentence. Put another way, in cases in which substantial assistance reductions were actually awarded, defendants ended up with a sentence that was just 39% as long as what they would have received had the minimum guideline sentence been imposed.

Sentences reduced for substantial assistance account for a growing percentage of Federal sentences. In 1989, they accounted for just 3.5% of all Federal guideline sentences (see below). Since then, their use has risen considerably, accounting for 19.7% of all guideline sentences in 1995.[2]

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[1]18 U.S.C. § 3553(e).

[2]In 1994, sentence reductions for substantial assistance accounted for 19.5% of all Federal guideline sentences, and in some Federal districts they were almost half of the sentences.

Year	Percent of cases
1989	3.5%
1990	7.5
1991	11.9
1992	15.1
1993	16.9
1994	19.5
1995	19.7

Responding to the continuing trend, the United States Sentencing Commission undertook a comprehensive study of substantial assistance.[3] Among other things, the overall study included:

(1) survey results from a questionnaire mailed to each United States attorney in the 94 Federal districts, which inquired into individual policies and practices regarding the filing of substantial assistance motions pursuant to USSG §5K1.1 and Rule 35(b) of the Federal Rules of Criminal Procedure; and,

(2) statistical results, based on analyses of the Commission's FY1994 sentencing data, indicating what factors affect whether or not a substantial assistance motion is filed by a prosecutor.

Regarding the latter, one of the Commission's findings was evidence of a possible racial disparity in the awarding of substantial assistance departures to drug traffickers.[4]

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[3]United States Sentencing Commission, Substantial Assistance Departures in the United States Courts, draft report, chapter 8, October 1995.

[4]Drug offenses (31%) generally, and drug trafficking specifically (34%), are the types most likely to receive a substantial assistance reduction. Of all the sentence reductions awarded in 1994 for substantial assistance, 67% went to defendants convicted of drug trafficking. The remaining 33% were mostly for defendants convicted of arson, money laundering, kidnapping, antitrust, racketeering, gambling, bribery, and auto theft.

Specifically, the Commission's data revealed that Federal prosecutors filed motions for substantial assistance sentence reductions less often when the defendant was black than when the defendant was white: among Federal defendants convicted of drug trafficking, 34% of blacks and 43% of whites received a sentence reduction for substantial assistance, an apparent disparity of 9 percentage points.[5] The 9-point disparity, though, was based on a simple comparison between the races, without any statistical controls for differences between the races that might help explain the disparity. However, when those controls were introduced, using the multivariate statistical technique "probit analysis," the Commission continued to find that blacks were less likely than whites to receive a substantial assistance reduction. Moreover, the size of the disparity was still estimated at 9 percentage points.

Reproducing the racial disparity

The FY1994 sentencing data were obtained from the Sentencing Commission for further analysis. The analysis used logit rather than probit analysis, although either technique is appropriate in studies investigating a dichotomous outcome, such as whether or not a sentence is reduced. Also, either is appropriate in situations in which the aim is to estimate the effect of one particular variable - the defendant's race, for example - while at the same time controlling for the effects of others - the conviction offense and the defendant's criminal history, for example. Both produce a statistical model containing numerical estimates of the impact on sentencing of each variable in the model. Lastly, the two are known to give nearly identical results.

Logit and probit results compared Probit results, along with names and brief descriptions of variables used in the probit model, are summarized in appendix A. The first aim was to learn whether the major findings from the probit model could be

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[5]To be precise, the Commission compared blacks to a racial category consisting of non-Hispanic whites plus American Indians, Asians, Pacific Islanders, and Aleuts. Since the vast majority were white, the racial category is called "white" in the reanalysis.

reproduced in a logit model. Toward that end, full effort was made to select variables for the logit analysis identical in all respects to those used in the probit analysis (see appendix B).

The probit model consisted of 33 independent variables thought to be associated with the decision of whether to award a sentence reduction for substantial assistance (coded 1 if awarded the reduction, 0 if not). Of the 33 variables in the probit model, information on 32 was available for the logit model. The 32 consisted of 3 types of variables:

Demographic characteristics: includes such factors as defendant's age, race, gender, citizenship, and education, all of which are considered legally irrelevant to the sentencing decision

Legally relevant characteristics: includes such factors as whether a weapon was used, type of drug trafficked, whether the sentence was governed by a mandatory minimum statute

Case processing characteristics: includes such information as region of U.S. where sentenced, caseload and plea rate in district where sentenced

The 32-variable logit model is shown in appendix C. It was compared to the probit model (appendix A) on these criteria:

- statistical significance ($p < .05$) of 32 included variables
- the "sign" (plus or negative) of the 32 coefficients[6]

Results (table 1):

- In both models, the same 15 variables were significant and the same 10 were not significant. All 15 agreed in sign.
- 5 variables were significant in the probit model but

[6]Note that signs shown in appendix A were reversed to make probit and logit results comparable.

not in the logit model: SOUTH, PROSCASELO, PROSCASEHI, GUNMANDMIN, GDLINEMIN

- 2 variables were not significant in the probit model but were in the logit model: PLEARATEHI, DRUGCASELO

Conclusion: The two models essentially produced the same results. That is, variables statistically significant in one were usually significant in the other; variables not significant in one were usually not significant in the other. With respect to race, both models indicated that, controlling for all other variables in the model, blacks were significantly less likely than whites to receive a substantial assistance reduction. The statistical significance of the race coefficient in the logit model was determined by the likelihood ratio test (a chi-square test, 1 degree of freedom) of the difference between the logit model with race and the same model without race.[7]

Size of racial disparity compared One of the major findings from the probit analysis was the 9-percentage point disparity. To learn whether this finding could be reproduced from the logit analysis, essentially the same method the Sentencing Commission used to estimate the size of the racial disparity from the probit model was used to estimate its size from the logit model. The method involved a series of steps:

Step 1. Multiply logistic regression coefficients (appendix C) by average values for 31 of the 32 variables (each of the 32 except the variable BLACK). For example, the AGE coefficient (-.0047) multiplied by the mean age of drug traffickers 33.22) equals -.15613; the GENDER coefficient (.3666) multiplied by the mean value on gender (.112) equals .041059. Step 1 resulted in 31 products.

Step 2. Sum the 31 products: -.62065.

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[7]The -2 log likelihood was 16512.599 for the 31-variable model without race, and 16463.682 for the 32-variable model with race. The likelihood ratio test statistic was 48.917. At 1 degree of freedom, the critical chi-square value at the .05 level is 3.841. Hence, the race coefficient was statistically significant.

Step 3. Multiply the BLACK coefficient (-0.4442) by the value assigned to black defendants on the BLACK variable ("1"), then add the product to the -0.62065, giving a sum for black defendants of -1.06485. To obtain a sum for white defendants, multiply the BLACK coefficient (-0.4442) by the value assigned to white defendants on the BLACK variable ("0"), then add the product to the -0.62065, giving -0.62065.

Step 4. Convert the two sums into predicted probabilities for whites and blacks. Formulas are:

$$\text{for whites: } 1/(1 + e^{0.62065}) = 0.349$$
$$\text{for blacks: } 1/(1 + e^{1.06485}) = 0.256$$

The difference in predicted probabilities was .093, or 9.3%.

Conclusion: To estimate the effect of race while holding constant all other variables in the model, the Sentencing Commission applied observed overall averages (grand means) to the probit coefficients of these other variables. Based on this method for comparing probabilities while holding constant other variables, the Sentencing Commission estimated from probit results that the probability of a sentence reduction for black defendants was about 9 percentage points lower for blacks than for whites. Applying essentially the same method to logit results also indicated a disparity of approximately 9 percentage points.

Defendant's race not found to have demonstrable value for predicting which defendants received reduced sentences

Various measures of racial disparity derived from the logit model all seem to suggest what could be viewed as a substantial difference between the races in terms of likelihood of receiving a sentence reduction:

- Applying the Sentencing Commission's estimation procedure to logit results (described immediately above), it is estimated that, holding constant the other factors in the model, the probability of sentence reduction was about 9 percentage points lower for blacks than whites.

- The -0.4442 BLACK coefficient (appendix C, under the heading "B") indicates that, holding constant the other factors, the log odds of receiving a sentence reduction are 0.4442 less for black than white defendants. Put a different way (since it is easier to think of odds rather than "log odds"), holding constant the other factors, the odds of a sentence reduction are lower for black than white defendants by a factor of 0.6413 (appendix C, under the heading "Exp (B)"). Taking the complement, the odds of sentence reduction are 36% lower for blacks than whites.

But if race is as relevant a factor in sentencing as these various measures of disparity all seem to suggest, a statistical model containing information on the defendant's race should outperform one excluding it in terms of correctly predicting which defendants received a sentence reduction. This section summarizes results of analyses designed to assess the predictive value of the defendant's race.

Single cutoff point Steps taken in the first set of analyses were:

Step 1. The 32-variable logit model (appendix C) produced for each defendant a predicted probability of receiving a substantial assistance reduction. Predicted probabilities can range from 0.0 to 1.0.

Step 2. Defendants with a predicted probability of 0.5 or greater were designated as "predicted to receive the sentence

reduction." Defendants with a predicted probability below 0.5 were designated as "not predicted to receive the reduction."

Step 3. Predictions were compared with whether the defendant actually received the sentence reduction. A correct prediction was scored when the model predicted a reduction and the defendant actually received one, or the model predicted no reduction and the defendant actually did not receive one. By this scoring method, the 32-variable model that included the defendant's race was found to have correctly predicted 70.25% of the outcomes (10,121 out of 14,407).

Step 4. To learn whether the defendant's race materially contributed to the 70.25% correct prediction rate, the logistic regression was re-run except this time the race variable was left out of the model. The correct prediction rate from the resulting 31-variable model was then calculated: 70.17% (10,110 out of 14,407).

Step 5. Lastly, results were compared between the two models. The correct prediction rate was 70.25% with race included and 70.17% without, and the number of correct predictions totaled 10,121 with race and 10,110 without. The difference in results between a model that included race and a model that excluded it is interpretable as the unique contribution that race makes to prediction, independent of whatever contributions it shares with other variables in the model. Hence, race added just 11 additional correct predictions and improved the correct prediction rate by less than one-tenth of one percentage point.

Multiple cutoff points: ROC analysis The 0.5 cutoff is an arbitrary cutoff point for assessing the predictive value of the defendant's race. Had, say, the 0.6 cutoff point instead been used (that is, predicted probability at or above 0.6 designated as predicted to receive the sentence reduction; predicted probability below 0.6 designated as not predicted to receive the reduction), the value of knowing the defendant's race would have been 41 additional correct predictions (since 9,907 - 9,866 = 41), not 11 (table 2). Similarly, had the 0.3 cutoff been used, the value of knowing the defendant's race would have been 2 fewer correct predictions (since 9,162 - 9,164 = -2). That is, knowing the defendant's race would actually have diminished the ability to predict. Obviously, then, the value of knowing race depends

on which cutoff is used. However, in 9 trials (identified in table 2), no cutoff added more than 55 correct predictions.

Rather than arbitrarily selecting a single cutoff for assessing the relevance of race to the sentencing decision, results from different cutoffs were analyzed using ROC analysis ("Receiver Operating Characteristic").[8] Steps in the ROC analysis are described next.

Step 1. Predicted probabilities from the 32-variable logit model (appendix C) were analyzed at 9 different cutoff points: 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9. At each cutoff point, two rates were calculated:

> the *true positive rate* (also called the *hit rate*), defined as the proportion of defendants with the reduced sentence who were correctly predicted to receive the reduction (the number of defendants at or above the cutoff who received the sentence reduction divided by the 4,920 who received the reduction); and,
>
> the *false positive rate* (also called the *false alarm rate*), defined as the proportion of defendants without the reduced sentence who were incorrectly predicted to receive a reduction (the number at or above the cutoff who did not receive the reduction divided by the 9,487 total who did not receive it).

Step 2. A plot of the two rates at the different cutoff points produced a ROC curve (figure 1). The area under the ROC curve provides useful information for evaluating how successful the 32-variable model was in predicting which defendants received the sentence reduction. Area under the curve equal to 1.0 (or 100%) indicates maximum success, possible only if the 4,920 defendants

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[8]Examples of ROC analysis in the field of criminology include Fergusson, D.M., J.K. Fifield, and S.W. Slater, "Signal Detectability Theory and the Evaluation of Prediction Tables," Journal of Research in Crime and Delinquency, July 1977, pp. 237-246; Douglas Mossman, "Assessing Predictions of Violence: Being Accurate About Accuracy," Journal of Consulting and Clinical Psychology, 1994, Vol. 62, No. 4, pp. 783-792.

with reduced sentences (reduced defendants) all had higher predicted probabilities than the 9,487 defendants without reductions (unreduced defendants). Area under the curve equal to 0.5 (50%) indicates chance success, possible if chance is considered a likely explanation for higher average predicted probabilities among reduced defendants as compared to unreduced defendants. Area under the curve equal to 0.0 (0%) indicates perfect negative success, possible only if predicted probability of receiving a reduction was greater for all 9,487 who did not receive a reduction than for all 4,920 who did.

Step 3. Area under the ROC curve for the 32-variable model with race (figure 1) was calculated at 0.722, or 72.2%. An area of 0.722 means that, 72.2% of the time, a randomly selected individual from the 4,920 defendants with reduced sentences has a predicted probability (of receiving a reduced sentence) greater than that for a randomly chosen individual from the 9,487 unreduced defendants. Put another way, an area of 72.2% means that for 27.8% (the complement of 72.2%) of all possible pairs of reduced and unreduced defendants, the pair member with the lower predicted probability actually turned out to be the pair member who received the reduction.

Step 4. To learn whether inclusion of the defendant's race contributed substantially to the 0.722, the logistic regression was re-run except this time the race variable was left out of the model. As before, true positive and false positive rates were calculated and graphed at the 9 different cutoff points (figure 2). Area under the resulting ROC curve for the 31-variable model excluding race was calculated at 0.721, or 72.1%.

Step 5. Lastly, the two results were compared. Area under the ROC curve was 72.2% when race was in the model versus 72.1% when race was excluded. The difference in area under the curve between the model that included race and the model that excluded it is interpretable as the unique contribution that race makes to prediction, independent of whatever contributions it shares with other variables in the model. The difference was only one-tenth of 1 percent and not statistically significant (one-tailed test,

p. > .05).[9]

Reconciling results The model with race and the model without race were not significantly different according to the Z-test of the difference in area under the two ROC curves, but were significantly different according to the chi-square likelihood ratio test. The racial disparity, then, was statistically significant according to one test and not significant according to the other.

The results can be reconciled. The apparent discrepancy arose because the level of data used in the two significance tests differed. The test in the ROC analysis was based on ranked data whereas the test of the race coefficient in the logit model was based on interval data.

To explain, the model without race produced one set of predicted probabilities and the model with race produced another. Consequently, there was one set of deviations between actual and predicted values on the dependent variable in the model without race and another set in the model with race. Since the deviations were smaller when the model included race than when the model excluded it - smaller, that is, to a degree that could not readily be explained by chance, as determined by the likelihood ratio test - the race coefficient was determined to be statistically significant. Statistical significance of a race coefficient in the logit model, then, depended on how much individual predicted probabilities changed when race was added to the model. Significant change implies improved accuracy of estimation of individual predicted probabilities.

The ROC analysis also involved a comparison of models with and without race, but the ROC analysis was concerned not with change in predicted probabilities but with change in probability-based ranking of cases. To explain, the logit model without race

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[9]To test the statistical significance of the difference in areas under the two ROC curves, a Z-test was selected that is appropriate in situations in which the two curves were derived from the same cases. Areas under the ROC curves and Z-test results were obtained from the CORROC2 Program, available from C.E. Metz, Dept. Of Radiology, Univ. Of Chicago, Chicago, IL.

produced predicted probabilities for reduced defendants (defendants who received a sentence reduction) and predicted probabilities for unreduced defendants, which were then compared by taking all possible pairs of reduced and unreduced defendants. For each pair, the comparison was concerned not with how much the reduced defendant's predicted probability differed from the unreduced defendant's (an interval level measurement), but merely with whether the reduced defendant's predicted probability was greater or less than the unreduced defendant's predicted probability (a rank level measurement). In other words, the latter determination involved ranking cases based on predicted probabilities. The area under the ROC curve formed from the model <u>without</u> race was the fraction of all possible pairs in which the reduced defendant's predicted probability was greater than the unreduced defendant's.

Assessing the significance of race involved comparing this area with the area under a ROC curve formed from a model <u>with</u> race. The new area was obtained by: a) adding race to the model, b) generating new predicted probabilities, c) using the new predicted probabilities to rank cases in each pairing, and d) calculating the new area under the ROC curve formed from the model with race. Lastly, a test was run to determine whether the new area was greater than the initial area formed from the model without race. Since the new area was not greater than the initial one - not greater, that is, by an amount attributable to normal sampling variability, as determined by a Z-test - the model with race was not said to have outperformed the model without race in terms of differentiating defendants who received sentence reductions from defendants who did not receive them.

To summarize, the chi-square likelihood ratio test indicated that adding race to the model improved the accuracy of estimation of individual probabilities. The Z-test of the difference in area under the two ROC curves indicated that the improvement in accuracy of the individual probabilities did not significantly affect the probability-based rank ordering of cases and, therefore, the area under the curve. Hence, the ROC test result did not conflict with the likelihood ratio test result but, rather, supplemented it, adding valuable new information relevant to assessing the statistically significant race coefficient in the logit model.

Size of racial disparity depends on which variables are in the logit model

The size of the racial disparity was found to depend on which variables were included in the logit model. Adding one additional relevant variable had a major impact, as results summarized in this section illustrate.

Nearly 20% of racial disparity disappeared when one variable was added to model Knowing which defendants were willing to provide substantial assistance to the government is critical to understanding why sentence reductions were selectively awarded to defendants. Unfortunately, the sentencing data contained no direct information on defendant's willingness to provide assistance. However, the data did include a variable describing the defendant's "mode of disposition" (labelled DISPOSE), i.e., a variable indicating whether the defendant pleaded guilty or stood trial. Since defendants who plead guilty are almost certainly ones more inclined to offer substantial assistance to prosecutors than defendants who go to trial, mode of disposition could be used as an indirect measure of willingness to provide assistance.

A check of the data confirmed that substantial assistance reductions were rarely given - 2% - to convicted trial defendants. The comparable figure was 39% for drug traffickers convicted by plea.

Whether adding mode of disposition affects logit results would depend on whether black defendants were less likely than whites to plead guilty. If black defendants were less likely, some of the black-white disparity in the awarding of substantial assistance reductions might be explained by a lesser willingness on the part of black defendants to cooperate with the government. Consistent with that possibility, trial was the mode of disposition for 8% of white drug traffickers but 18% of black traffickers.

When mode of disposition was added to the regression, the BLACK coefficient became smaller in the resulting 33-variable logit model (appendix C). Consequently, the size of the racial disparity narrowed. Without mode of disposition, the black-white disparity was 9.3 percentage points. With mode of disposition, it was 7.7 points, a reduction in racial disparity of nearly

20%.

Among other things, the narrowed disparity attributable to adding mode of disposition illustrates that the impact (if any) race is said to have on probability of sentence reduction depends on which variables are in the model. If relevant variables known to be related to race are missing from the model, the model will incorrectly estimate the impact of race.[10]

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[10]Similarly when a variable describing the defendant's acceptance of responsibility, as defined by the Federal sentencing guidelines (see USSG §3E1.1), was added rather than "mode of disposition," the black-white disparity decreased from 9.3% to 7.7%.

Relevant factors are not included in the model

The soundness of the 32-variable logit model depends on whether the model includes the important factors relevant to substantial assistance practices. If relevant factors are missing, the model can give misleading results.

One way of identifying relevant factors is to survey Federal prosecutors and ask them what influences whether or not they file a substantial assistance motion. As part of its study of substantial assistance reductions, the United States Sentencing Commission conducted such a survey (Substantial Assistance Departures in the United States Courts, draft report, chapter 4, October 1995). The U.S. Attorneys identified 5 types of defendant conduct resulting in motions and 6 types of conduct precluding motion, shown below along with percentages saying the filing of a motion is warranted or precluded:

Defendant conduct resulting in motion

1. testimony under oath (100%)
2. information leading to prosecution of others (100%)
3. information regarding criminal activities of others (100%)
4. information about defendant's own activity (44%)
5. active participation in investigation of another (100%)

Defendant conduct precluding motion

1. defendant's role in offense (40%)
2. defendant charged under certain statutes (18%)
3. defendant engaged in violent acts (18%)
4. defendant whose codefendants had already cooperated (25%)
5. defendant with a criminal history (16%)
6. defendant continued misconduct while cooperating (61%)

Comparing the above 11 characteristics to those in the 32-variable logit model (appendix C), several conclusions were reached:

- The 32-variable logit model was missing information on most of the 11 defendant characteristics that prosecutors said influenced whether or not they file motions for substantial assistance reductions.

- Of the 11 characteristics, the model had information on 4, all listed under the heading "conduct precluding motion" (defendant's role in offense, defendant charged under certain statutes, defendant engaged in violent acts, and defendant with a criminal history). However, except for "defendant's role," only small percentages of prosecutors said these particular characteristics applied. Hence, collectively the 4 were ones that had the least relevance to substantial assistance practices.

- Of the 5 characteristics that majorities of prosecutors said applied (testimony under oath, information leading to prosecution of others, information regarding criminal activities of others, active participation in investigation of another, defendant continued misconduct while cooperating), none were included in the model.

Implications of missing information: an illustration If it were known that relevant factors missing from the model were all ones unrelated to race, the model still might provide a sound basis for detecting a racial disparity. However, not much is known about the missing factors, and what little is known about at least one of them - defendant continued misconduct while cooperating - suggests a connection to race.

What is known about continued misconduct is from survey data on Federal defendants released in 1990 prior to final disposition of their case. The survey did not record which defendants were cooperating with prosecutors during their pretrial release, but it did record the defendant's race and whether or not the defendant engaged in misconduct (failed to make all court appearances, rearrested for a new crime, or violated a technical condition of release). Survey results indicated that black Federal defendants (20%) were twice as likely as white Federal defendants (10%) to get into trouble while out on bail or other

release.[11]

In light of these findings, a race-neutral interpretation can be given to the logit model: what might appear from logit results as evidence of prosecutors unwilling to seek shorter sentences for black defendants might simply be evidence of prosecutors unwilling to seek shorter sentences for defendants who get into trouble while out on bail.

Pretrial misconduct might also explain other logit results, such as:[12]

Gender Males were less likely than females to receive a sentence reduction. Rates of pretrial misconduct were higher for males (14%) than females (11%).

Criminal History Repeat offenders (those with a criminal history) were less likely than first-offenders to receive a sentence reduction. Repeat offenders were less likely to remain trouble-free while on pretrial release. The percentage who got into trouble was:

26% of those with 5 or more prior convictions
19% of those with 2 to 4 prior convictions
15% of those with 1 prior conviction
10% of those with 0 prior convictions.

The overall pattern here is clear: characteristics associated with increased likelihood of continued misconduct are generally the same characteristics associated with reduced likelihood of substantial assistance reduction. The implication of these

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[11]Brian Reaves, Pretrial Release of Federal Felony Defendants, BJS report NCJ-145322, February 1994, table 9.

[12]Hispanics were less likely than non-Hispanics to receive a substantial assistance reduction. However, pretrial misconduct would not explain their lower rate because most Hispanics were not released prior to their case being disposed. Their lower rate might instead by partly explained by their being confined. Certain forms of assistance are precluded when the defendant is in confinement.

findings is that logit results are subject to widely varying interpretations owing to the fact that the logit model contains no information on pretrial misconduct. One interpretation is that, in their decisions to file motions for reduced sentences for substantial assistance, prosecutors give preferential treatment to whites, females, and first-offenders. However, an entirely different interpretation can be given to these results. It is that prosecutors give preferential treatment to defendants who stay out of trouble while on pretrial release, a practice that happens to impact certain segments more than others.

Figure 1. ROC curve of 32-variable logit model (model includes race variable)
Note: cutoffs shown in parentheses

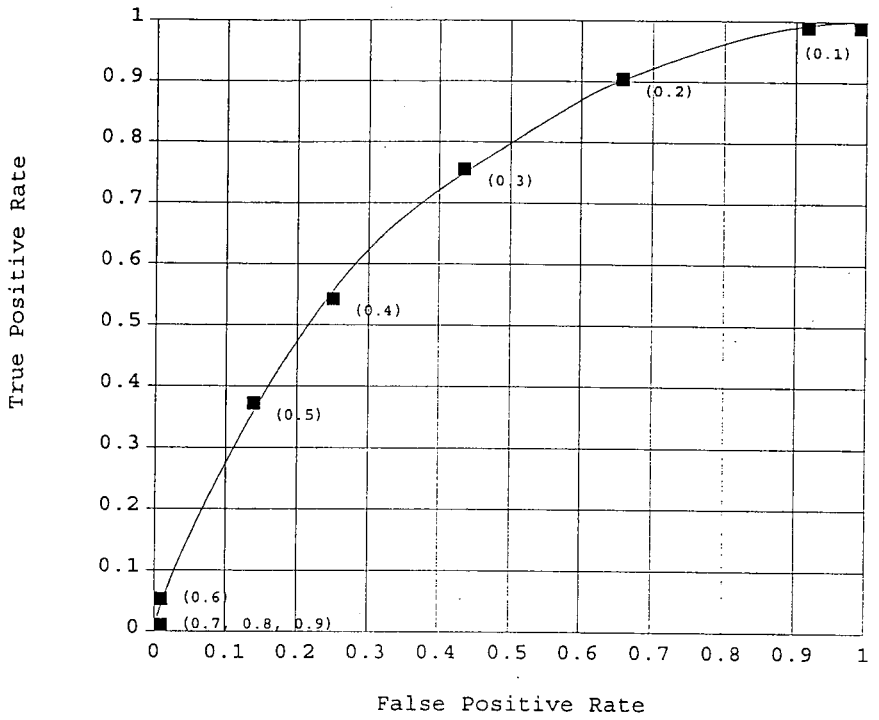

Figure 2. ROC curve of 31-variable logit model (model excludes race variable)
Note: cutoffs shown in parentheses

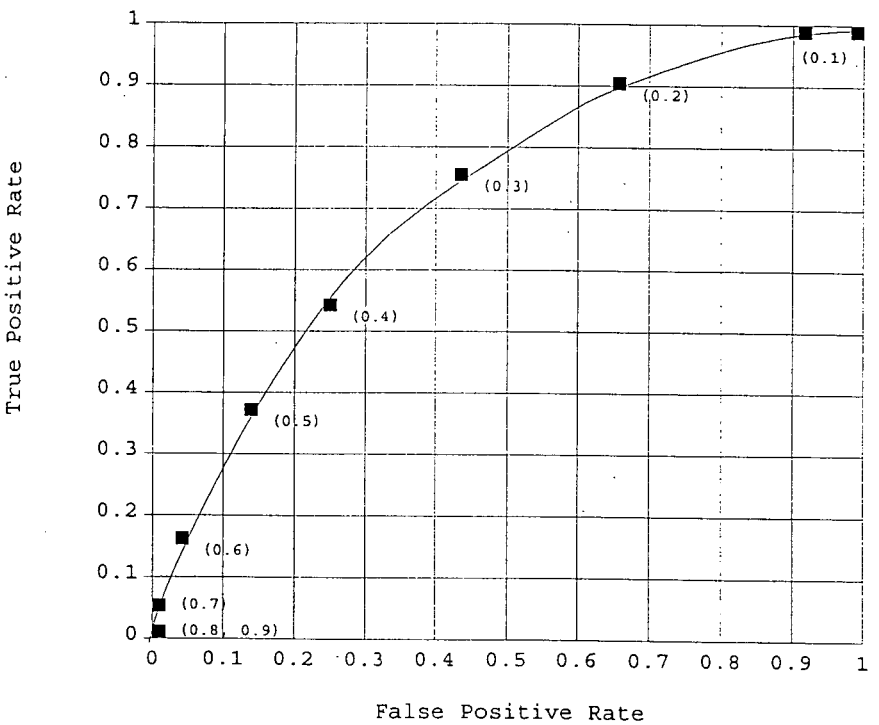

Table 1. Comparison of 33-variable probit model and 32-variable logit model

	Sign		Significant (s) or not significant (ns)	
Variable	Probit	Logit	Probit	Logit
AGE	-	-	s	s
GENDER	+	+	s	s
EDUC	+	+	s	s
BLACK	-	-	s	s
HISPANIC	-	-	s	s
USCITIZEN	-	-	s	s
NORTHEAST	+	+	s	s
SOUTH	-	+	s	ns
WEST	-	+	ns	ns
JUDGEYR	-		ns	
DISTCASELOA	+	-	ns	ns
PROSCASELO	-	-	s	ns
PROSCASEHI	-	-	s	ns
DRUGCASELO	+	-	ns	s
DRUGCASEHI	+	-	ns	ns
PLEARATELO	-	-	ns	ns
PLEARATHI	+	+	ns	s
JKRATELO	-	-	s	s
JKRATEHI	+	+	s	s
AGGROLE	-	+	ns	ns
MITROLE	+	+	s	s
BODILYINJURY	-	-	ns	ns
CRIMINALHIST	-	-	s	s
DRUGMANDMI	+	+	s	s
GUNMANDMIN	-	-	s	ns
WEAPONINVOL	-	-	ns	ns
GDLINEMIN	+	+	s	s
#COUNTS	-	-	s	s
HEROIN	-	-	s	s
OTHERDRG	-	+	ns	ns
METH	+	+	ns	ns
CRACK	+	+	ns	ns
COCAINE	+	+	s	s
Constant	-	-	s	s

Table 2. Comparison of correct predictions between 32-variable logit model that includes race variable and 31-variable logit model that excludes race variable.

Prediction cutoff: defendant's predicted probability of sentence reduction equal to or greater than:	Number of correct predictions (a) When the model includes the race variable	(b) When the model excludes the race variable	Additional correct predictions from knowing whether defendent was white or black (a-b)
0.1	5,589	5,534	55
0.2	7,618	7,574	44
0.3	9,162	9,164	-2
0.4	9,933	9,929	4
0.5	10,121	10,110	11
0.6	9,907	9,866	41
0.7	9,645	9,609	36
0.8	9,494	9,491	2
0.9	9,487	9,487	0

APPENDIX A

Source: United States Sentencing Commission, Substantial Assistance Departures in the United States Courts, Draft Final Report, October 1995, Appendix F, Tables 10 and 14

Table 10

PROBIT OUTPUT: DRUG TRAFFICKING ONLY CASES MODEL

Dependent Variable 5KDEPART
Class Level Information

Class	Levels	Values
5KDEPART	2	0 1

Number of observations used = 14157
Likelihood for NORMAL -8116.664499

Weighted Frequency Counts for the Ordered Response Categories

Level	Count
0	9334
1	4823

Observations with Missing Values =1334

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	0.52687831	0.075926	48.1544	0.0001
AGE	1	0.0026337	0.001253	4.4191	0.0355
GENDER	1	-0.2015322	0.036513	30.4651	0.0001
EDUC	1	-0.1255629	0.023955	27.4737	0.0001
BLACK	1	0.27969629	0.038542	52.6628	0.0001
HISPANIC	1	0.34493666	0.03699	86.9583	0.0001
USCITIZEN	1	0.1433297	0.034353	17.4077	0.0001
NORTHEAST	1	-0.1298967	0.047786	7.3893	0.0066
SOUTH	1	0.15253966	0.040673	14.0655	0.0002
WEST	1	0.0500241	0.052691	0.9013	0.3424
JUDGEYR	1	0.02541938	0.025957	0.9589	0.3274
DISTCASELOAD	1	-0.0000466	0.000031	2.2017	0.1379
PROSCASELO	1	-0.12611279	0.034737	13.1808	0.0003
PROSCASEHI	1	-0.0961593	0.029979	10.2881	0.0013
DRUGCASELO	1	-0.0590029	0.0394	2.2426	0.1343
DRUGCASEHI	1	-0.0169125	0.033018	0.2623	0.6085
PLEARATELO	1	0.03089999	0.03204	0.9301	0.3348
PLEARATEHI	1	-0.0075654	0.02919	0.0671	0.7955
5KRATELO	1	0.41243568	0.040719	102.5935	0.0001
5KRATEHI	1	-0.4484921	0.026906	277.8416	0.0001
AGGROLE	1	0.03280965	0.043401	0.5714	0.4497
MITROLE	1	-0.1065324	0.031838	11.1961	0.0008
BODILYINJURY	1	0.38504809	0.371337	1.0752	0.2998
CRIMINALHIST	1	0.07034422	0.025085	7.8637	0.0050
DRUGMANDMIN	1	-0.4822622	0.028654	283.2694	0.0001
GUNMANDMIN	1	0.14148491	0.059661	5.6239	0.0177
WEAPONINVOL	1	0.03735576	0.037802	0.9765	0.3231
GDLINEMIN	1	-0.0007323	0.00017	18.5364	0.0001
#COUNTS	1	0.07019192	0.007191	95.2678	0.0001
HEROIN	1	0.17606477	0.050849	11.9887	0.0005
OTHERDRUG	1	0.04376703	0.066066	0.4388	0.5077
METH	1	-0.061712	0.052297	1.3924	0.2380
CRACK	1	-0.0485717	0.047396	1.0502	0.3055
COCAINE	1	-0.101488	0.034098	8.8585	0.0029

Table 14

PROBIT AND REGRESSION VARIABLE DEFINITIONS AND CODES (ALPHABETICAL ORDER)

ANALYSIS VARIABLE	DEFINITION AND CODES
#COUNTS	Actual number of defendant's counts of conviction
5KDEPART	Presence of §5K1.1 departure 0 = Upward, downward, or no Departure 1 = §5K1.1 Departure • = Missing/Not Applicable
5KRATEHI	High district §5K1.1 rate 0 = Low or medium §5K1.1 rate 1 = High §5K1.1 rate • = Missing
5KRATELO	Low district §5K1.1 rate 0 = High or medium §5K1.1 rate 1 = Low §5K1.1 rate • = Missing
AGGROLE	Aggravating role adjustment 0 = Did not receive 1 = Received role adjustment • = Missing
BLACK	Defendant non-Hispanic Black classification 0 = White, Other, or Hispanic classification 1 = Non-Hispanic Black • = Missing
BODILYINJURY	Bodily Injury specific offense characteristic (SOC) adjustment 0 = Did not receive 1 = Received • = Missing
COCAINE	Primarily powder cocaine involvement in offense 0 = No powder cocaine (includes missing) 1 = Powder cocaine
CRACK	Primarily crack cocaine involvement in offense 0 = No crack cocaine (includes missing) 1 = Crack cocaine
CRIMINALHIS	Criminal History Category 0 = Category I 1 = Category II through Category VI and Career Offender • = Missing

Table 14 (cont.)

ANALYSIS VARIABLE	DEFINITION AND CODES
DISTCASELOAD	Actual number of cases sentenced in district in FY1994
DRUGCASEHI	High district drug caseload 0 = Low or medium drug caseload 1 = High drug caseload • = Missing
DRUGCASELO	Low district drug caseload 0 = High or medium drug caseload 1 = Low drug caseload • = Missing
DRUGMANDMIN	Presence of mandatory minimum drug statute 0 = Less than 60-month minimum (includes missing) 1 = 60 or more month minimum (includes life)
DRUGTRAF	Drug trafficking primary offense type 0 = All other offenses 1 = Drug trafficking • = Missing
EDUC	Education 0 = Less than high school diploma 1 = Some degree (high school diploma or greater) • = Missing
FIREARM	Firearms primary offense type 0 = All other offenses 1 = Firearms • = Missing
FRAUD	Fraud primary offense type 0 = All other offenses 1 = Fraud • = Missing
GDLINEMIN	Minimum of the guideline range for defendant (in months) 0 - 800 = Valid Range in months • = Missing, Multiple GL Ranges, N/A, 18§924(c) only, and Life Sentences
GDMINLO	Low category of minimum of guideline range for defendant 0 = 12 months or more 1 = Less than 12 months • = Missing
GENDER	Gender of defendant 0 = Male 1 = Female • = Missing

Table 14 (cont.)

ANALYSIS VARIABLE	DEFINITION AND CODES
GUNMANDMIN	Presence of mandatory minimum gun statute 0 = Less than 60-month minimum for 18§924(c)/Less than 120 months for 18§924(e) (includes missing) 1 = 60-month or more minimum for 18§924(c)/120 months or more for 18§924(e) • = Missing
HEROIN	Primarily heroin involvement in offense 0 = No Heroin (includes missing) 1 = Heroin
HISPANIC	Defendant Hispanic classification 0 = White non-Hispanic, Black non-Hispanic, or Other Non-Hispanic 1 = Hispanic ethnicity, regardless of racial classification • = Missing
JUDGEYEAR	Judge appointment pre-guideline 0 = Appointed 1989 or after 1 = Appointed pre-1989 • = Missing
LARCENY	Larceny primary offense type 0 = All other offenses 1 = Larceny • = Missing
MARIJ	Primarily marijuana involvement in offense 0 = No marijuana (includes missing) 1 = Marijuana
METH	Primarily methamphetamine involvement in offense 0 = No Methamphetamine (includes missing) 1 = Methamphetamine
MIDWEST	Midwestern U.S. Census Bureau geographical region 0 = All other regions 1 = Midwestern region • = Missing
MITROLE	Mitigating role adjustment 0 = Did not receive 1 = Received role adjustment • = Missing
MONEYLAUNDER	Money laundering primary offense type 0 = All other offenses 1 = Money laundering • = Missing

Table 14 (cont.)

ANALYSIS VARIABLE	DEFINITION AND CODES
NONMINORITY	Defendant non-Hispanic, non-minority classification 0 = Black or Hispanic classification 1 = Non-Hispanic White or non-Hispanic other race (i.e. Asian, Native American, etc.) • = Missing
NORTHEAST	Northeastern U.S. Census Bureau geographical region 0 = All other Regions 1 = Northeastern Region • = Missing
OTHERDRUG	Primarily other drug involvement in offense 0 = Crack cocaine, powder cocaine, marijuana, methamphetamine, or heroin (includes missing) 1 = Any other drug than those listed above
PERCENTDEPART	§5K1.1 sentence degree of departure (in percent) from the defendant's guideline minimum (sentences of probation or alternative methods of confinement only defined as zero months of prison)
PLEARATEHI	High district plea rate 0 = Low or medium plea rate 1 = High plea rate • = Missing
PLEARATELO	Low district plea rate 0 = High or medium rate 1 = Low plea rate • = Missing
PROSCASEHI	High prosecutor criminal caseload 0 = Low or medium caseload 1 = High caseload • = Missing
PROSCASELO	Low prosecutor criminal caseload 0 = Medium or high caseload 1 = Low caseload • = Missing
RACKETEER	Extortion/racketeering primary offense type 0 = All other offenses 1 = Extortion/racketeering • = Missing
ROBBERY	Robbery primary offense type 0 = All other offenses 1 = Robbery • = Missing

Table 14 (cont.)

ANALYSIS VARIABLE	DEFINITION AND CODES
SOUTH	Southern U.S. Census Bureau geographical region 0 = All other regions 1 = Southern region • = Missing
USCITIZEN	U.S. Citizenship status 0 = U.S. citizen 1 = Non-U.S. citizen (legal and illegal aliens) • = Missing
WEAPONINVOL	Weapon involvement in offense 0 = No weapon (includes missing) 1 = Weapon specific offense characteristic (SOC) or 18 U.S.C. § 924(c)
WEST	Western U.S. Census Bureau geographical region 0 = All other regions 1 = Western region • = Missing

APPENDIX B

Databases compared Before attempting to reproduce the probit results using logit analysis, the fiscal year 1994 database available for the reanalysis was compared to the database used in the probit analysis (described in appendix A). The comparison centered on three criteria:

number of cases in database

number of cases with "complete" (non-missing) data on the variables used in the Commission's probit analysis

percent of "complete" cases receiving a substantial assistance reduction

Results:

Number of variables:

Probit	33
Logit	32 (no information on "judge year")

Number of drug traffickers in database:

Probit	15,491
Logit	15,491

Number of drug traffickers with complete information on all 32 variables:

Probit	14,157
Logit	14,407

Of drug trafficking cases with complete information, percent that received a substantial assistance sentence reduction:

Probit	34.1%
Logit	34.2%

Conclusion: The two databases essentially matched. The main differences were: 1) judge-year variable not available for the logit analysis; 2) slightly more cases in the logit analysis than in the probit analysis.

APPENDIX C

LOGIT OUTPUT: DRUG TRAFFICKING CASES MODEL (32 variables)

---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
AGE	-0.0047	0.0021	5.1328	1	0.024	-0.013	0.9953
GENDER	0.3666	0.0601	37.1721	1	0	0.0436	1.4429
EDUC	0.1914	0.0395	23.4392	1	0	0.034	1.2109
BLACK	-0.4442	0.0637	48.5698	1	0	-0.05	0.6413
HISPANIC	-0.5786	0.0622	86.4008	1	0	-0.068	0.5607
USCITIZEN	-0.2457	0.0573	18.3691	1	0	-0.03	0.7822
NORTHEAST	0.4258	0.1066	15.9571	1	0	0.0275	1.5308
SOUTH	0.1257	0.08	2.4654	1	0.116	0.005	1.1339
WEST	0.1469	0.1145	1.6463	1	0.2	0	1.1582
DISCASELOAD	-2.8E-06	5.148E-05	0.0029	1	0.957	0	1
PROSCASELO	-0.034	0.0653	0.2702	1	0.603	0	0.9666
PROSCASEHI	-0.0654	0.0601	1.1828	1	0.277	0	0.9367
DRUGCASELO	-0.1647	0.0755	4.7504	1	0.029	-0.012	0.8482
DRUGCASEHI	-0.0282	0.0681	0.1714	1	0.679	0	0.9722
PLEARATELO	-0.0903	0.0534	2.8589	1	0.091	-0.007	0.9136
PLEARATEHI	0.3361	0.0596	31.8012	1	0	0.0401	1.3994
5KRATELO	-0.7776	0.0718	117.2829	1	0	-0.079	0.4595
5KRATEHI	0.8004	0.0457	307.3081	1	0	0.1285	2.2265
AGGROLE	0.0461	0.0719	0.411	1	0.522	0	1.0472
MITROLE	0.1432	0.0531	7.2745	1	0.007	0.0169	1.154
BODILYINJURY	-0.7869	0.6685	1.3856	1	0.239	0	0.4553
CRIMINALHIST	-0.0936	0.0421	4.9389	1	0.026	-0.013	0.9106
DRUGMANDMI	0.9217	0.0479	370.9533	1	0	0.1412	2.5136
GUNMANDMIN	-0.045	0.1008	0.199	1	0.656	0	0.956
WEAPONINVOL	-0.0388	0.0633	0.3765	1	0.54	0	0.9619
GDLINEMIN	0.0007	0.0003	4.504	1	0.034	0.0116	1.0007
#COUNTS	-0.1539	0.0177	75.4455	1	0	-0.063	0.8573
HEROIN	-0.2801	0.0861	10.5691	1	0.001	-0.022	0.7557
OTHERDRUG	0.052	0.1063	0.2399	1	0.624	0	1.0534
METH	0.1139	0.0869	1.7153	1	0.19	0	1.1206
CRACK	0.0746	0.0796	0.8775	1	0.349	0	1.0774
COCAINE	0.1637	0.0574	8.1422	1	0.004	0.0182	1.1779
Constant	-1.0672	0.1179	81.8976	1	0		

APPENDIX D

LOGIT OUTPUT: DRUG TRAFFICKING CASES MODEL (33 variables)

---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
AGE	-0.0026	0.0022	1.3792	1	0.24	0	0.9974
GENDER	0.4158	0.0627	43.9354	1	0	0.0476	1.5156
EDUC	0.1938	0.0413	22.0277	1	0	0.0329	1.2139
BLACK	-0.3957	0.0664	35.5277	1	0	-0.043	0.6732
HISPANIC	-0.5505	0.0644	72.9515	1	0	-0.062	0.5767
USCITIZEN	-0.257	0.0596	18.5729	1	0	-0.03	0.7734
NORTHEAST	0.3613	0.1109	10.6138	1	0.001	0.0216	1.4352
SOUTH	0.1068	0.0836	1.6319	1	0.201	0	1.1127
WEST	0.1087	0.1194	0.8297	1	0.362	0	1.1149
DISCASELOAD	-4.2E-05	5.355E-05	0.6042	1	0.437	0	1
PROSCASELO	-0.0364	0.0681	0.286	1	0.593	0	0.9642
PROSCASEHI	-0.0622	0.0627	0.9843	1	0.321	0	0.9397
DRUGCASELO	-0.211	0.0783	7.2659	1	0.007	-0.017	0.8098
DRUGCASEHI	-0.0411	0.0716	0.3297	1	0.566	0	0.9597
PLEARATELO	-0.0852	0.0562	2.2975	1	0.13	-0.004	0.9183
PLEARATEHI	0.2875	0.0621	21.4461	1	0	0.0324	1.3331
[illegible]KRATELO	-0.8107	0.0736	121.351	1	0	-0.08	0.4445
[illegible]KRATEHI	0.7908	0.0476	275.9935	1	0	0.1217	2.2051
AGGROLE	-0.1124	0.0771	- 2.1255	1	0.145	-0.003	0.8937
MITROLE	0.1753	0.0549	10.1976	1	0.001	0.0211	1.1916
BODILYINJURY	-0.9322	0.7313	1.6248	1	0.202	0	0.3937
CRIMINALHIST	-0.2026	0.0442	20.9653	1	0	-0.032	0.8166
DRUGMANDMI	0.8996	0.049	336.5004	1	0	0.1345	2.4586
GUNMANDMIN	0.2147	0.1073	4.0016	1	0.046	0.0104	1.2395
WEAPONINVOL	-0.1456	0.0663	4.8288	1	0.028	-0.012	0.8645
GDLINEMIN	0.0037	0.0004	105.2783	1	0	0.0747	1.0037
#COUNTS	-0.0476	0.0146	10.622	1	0.001	-0.022	0.9535
HEROIN	-0.2907	0.0889	10.6943	1	0.001	-0.022	0.7478
OTHERDRUG	-0.026	0.1088	0.0571	1	0.811	0	0.9743
METH	0.0508	0.0905	0.3151	1	0.575	0	1.0521
CRACK	-0.0396	0.0831	0.2274	1	0.633	0	0.9612
COCAINE	0.1156	0.0596	3.7639	1	0.052	0.0098	1.1225
DISPOSE	-3.2604	0.1348	585.0294	1	0	-0.178	0.0384
Constant	-1.1637	0.1223	90.472	1	0		