

RESEARCH SERIES ON THE RECIDIVISM OF
FEDERAL GUIDELINE OFFENDERS

RELEASE 1

MEASURING RECIDIVISM: THE CRIMINAL HISTORY COMPUTATION OF THE FEDERAL SENTENCING GUIDELINES

A COMPONENT OF THE
FIFTEEN YEAR REPORT
ON THE U.S. SENTENCING COMMISSION'S
LEGISLATIVE MANDATE



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When sentencing offenders under the guidelines, federal judges reference two axes of a sentencing table to determine the appropriate sentencing range (prior to consideration of a warranted departure). The vertical axis of the sentencing table contains 43 “offense levels” designed to quantify the seriousness of the instant offense. Along the horizontal axis lie six “criminal history categories” (CHCs) designed to quantify the extent and recency of an offender’s past criminal behavior. The table cell in which the offense level and the criminal history level intersect displays the minimum and maximum number of months for an offender’s recommended sentence.

Inherent in using the horizontal axis of the sentencing table is the notion that prior criminal behavior warrants incremental punishments: the more extensive an offender’s criminal history, the harsher the sentence should be. This notion is formally justified in terms of culpability (just punishment), deterrence, incapacitation, and limited rehabilitation potential.¹ The Commission recognizes the importance of measuring accurately such prior criminal behavior and future recidivism risk, thus improving the goals of crime control.²

In developing the guidelines’ Chapter Four criminal history component, the first U.S. Sentencing Commissioners evaluated several preexisting prediction tools. Due to pressing congressional deadlines, the guidelines’ criminal history measure did not emanate from its own direct empirical evidence. Instead, the chosen criminal history instrument combined elements from the already validated U.S. Parole Commission’s “Salient Factor Score” and the “Proposed Inslaw Scale.”³ It was reasoned that the Salient Factor Score’s high predictive power would transfer, at least in part, to the nascent guidelines’ criminal history measure. While the new guidelines’ criminal history measure combined elements of the preexisting Salient Factor Score and the Proposed Inslaw Scale, it also added elements aimed at achieving philosophical and practical concerns specific to sentencing federal defendants. The Sentencing Commission currently uses the criminal history measure as a tool to measure offender culpability, to deter criminal conduct, and to protect the public from further crimes of the defendant.⁴

Since the time the sentencing Guidelines Manual was first released, the introductory section

¹USSG Ch. 4, Pt. A, intro. comment. The U.S. Sentencing Commission, 1987, 4, cites the U.S. Supreme Court ruling in *Graham v. West Virginia*, 224 U.S. 616,623 (1912) that states “the repetition of criminal conduct aggravates the guilt and justifies heavier penalties when they are again convicted.”

²U.S. Sentencing Commission, 1987, 41.

³U.S. Sentencing Commission, 1987, 43; Hoffman and Beck 1997, 1.

⁴USSG Ch. 4, Pt. A, intro. comment

of Chapter Four has always stated that in order to protect society from known criminals, the criminal history measure should take into account *culpability* (i.e., harsher punishments for offenders with aggravated prior criminal backgrounds) and *recidivism* (i.e., the likelihood of re-offending). Furthermore, the way in which the sentencing guidelines account for culpability and recidivism should be “consistent with the extant empirical research” and should incorporate “additional data insofar as they become available in the future.”⁵ The Commission’s intention to follow these directions is reflected in its early research agenda, as well as in staff resources spent on preliminary recidivism projects conducted in the early years of the Sentencing Commission.⁶

In fact, however, a delay in beginning a vigorous validity test of the criminal history measure was unavoidable. Such a project had to await the simple passage of time. In order to conduct a recidivism study, enough federal offenders would have to be convicted and then released to the community. Once released, a research design requires that offenders sentenced under the guidelines be in the community and at risk of recidivating for a follow-up period of several years.

As such, a fair assessment of the guidelines’ new criminal history measure would require time: time for the guidelines to adjust to its early constitutional/legal challenges, time for judges to become familiar with the guideline process, time for the stabilization of a system of data collection from district courts, and time for adequate observation periods to elapse so that offenders with prison sentences as long as five years would have been released into the community for at least two years. Nonetheless, even given these necessary time requirements, the delayed validation of the criminal history measure generated concern among judicial personnel and sentencing practitioners that the criminal history measure might not accurately reflect recidivism risk, may be too complex to apply correctly, fail to reflect differences in past criminal behavior among federal offenders, and sustain disparate sentencing practices the Sentencing Reform Act aimed to diminish.⁷

This report serves as a “performance review” of criminal history’s predictive ability. Much like performance reviews for employees, the performance review of the criminal history measure includes a discussion of areas where performance is in need of improvement, is satisfactory, or is exceeding expectations. As such, it assesses the predictive power of the criminal history measure, determining whether it predicts better than random chance, and, if so, by *how much*. Emanating from this performance analysis, the reports in the recidivism project series examine the recidivism contributions of current criminal history components and suggest modifications or changes to improve predictive accuracy.

Using data collected from guideline federal offenders sentenced in fiscal year 1992, the current study examines in detail the predictive statistical power of the criminal history measure, responds to the Sentencing Commission’s initial intentions, fills the void of empirical evidence about the criminal history measure, and addresses current criticisms of the CHC.

⁵Ibid.

⁶Betsey, 1989; Swenson, 1990; Wilkins, 1990; Schmidt and Garner, 1991.

⁷Hoffman and Beck 1997, 192.

A. The Recidivism Project

The recidivism study data are composed of a stratified, random sample of 6,062 U.S. citizens⁸ who were sentenced under the federal sentencing guidelines in fiscal year 1992.⁹ Data on criminal behavior prior to the federal instant offense, as well as demographic and offender characteristics, were collected from the federal pre-sentence reports (PSRs) and other court documents submitted to the Sentencing Commission by U.S. district courts. Prison release date information was extracted from the SENTRY datafile of the Federal Bureau of Prisons in the U.S. Department of Justice. Recidivism information was obtained from the “RAP” sheet data of the Federal Bureau of Investigation’s Criminal Justice Information Services Division office.

The sample of offenders in the recidivism analysis represents the total 28,519 sentenced federal citizen offenders in the Commission’s fiscal year 1992 datafile where the following “two year window inclusion” conditions were met:

- a pre-sentence report (PSR) from a fiscal year 1992 sentencing was submitted to the Sentencing Commission;
- a “RAP” sheet was located on the FBI datafile; and
- for offenders receiving prison sentences, the release from prison occurred at least two years prior to June 1, 2001.

Given the project schedule for “RAP” sheet data collection in October 2001, an offender had to have been released from prison by June 1, 1999. Because the sampled offenders were sentenced in fiscal year 1992 (i.e., between October 1, 1991 and September 30, 1992), prison sentences as long as seven years are available for study.¹⁰ The selection of these specific dates reflects the Commission’s specific interest in recidivism impacts of mandatory minimum sentences. The effect of five year mandatory minimum sentences can be analyzed using the project’s sampling strategy.

With the recidivism study’s prison release deadline established as June 1, 2001, there were

⁸Due to alien deportation following conviction for criminal behavior, it is difficult to measure recidivism of noncitizens convicted of federal crimes. A companion report in this recidivism project series, “Recidivism of Fiscal Year 1995 Noncitizen Federal Offenders,” addresses citizenship issues in recidivism research.

⁹Details on the structure, methodology, and statistical techniques of the analysis are documented in the project’s companion report, “Background and Methodology of the U.S. Sentencing Commission’s 2003 Recidivism Study.”

¹⁰While the two year recidivism follow-up period limit was set at June 1, 2001, the actual collection of FBI “RAP” sheet data did not occur until October 2001. The four month delay between June and October assured that “RAP” sheet data would reflect all events prior to June 1. The intervening months accounted for administrative processing time to update fingerprint card information on the FBI datafile, thus minimizing any potential bias due to the states’ differential schedules for reporting data to the FBI.

offenders in the sample who either were still in prison on this date, or had at this time been released from prison for less than two years. Exhibit 1 illustrates the impact of the study definition on offender inclusion in the study. For the entire recidivism sample, 9.3 percent of sample offenders are not in the analysis because they had not finished serving their prison time.¹¹ In addition, for the entire recidivism sample, an additional 5.4 percent were released from their prison terms but did not have a two year “at risk” window of recidivism opportunity by June 1, 2001. Even with these limitations, however, 85.3 percent of the total recidivism sample is included in the analysis reported here. Not included in the analysis are those offenders with sentences roughly longer than seven years who are disproportionately found in the higher CHCs, particularly CHC VI.¹²

B. Recidivism Definitions

Recidivism results are presented using two substantive definitions. The first, or “primary,” definition includes the first occurring of any one of the following three types of events during the offender’s initial two years back in the community:

- a re-conviction for a new offense;
- a re-arrest with no conviction disposition information available on the post-release criminal history record;¹³ or
- a supervision revocation (probation or post prison supervision).

The second “re-conviction only” recidivism definition limits the recidivism definition to re-conviction events during the two year follow-up period. As such, under this secondary definition, recidivism is measured as the first occurring re-conviction for a new offense during the initial two years back in the community.

The use of two different recidivism definitions addresses the state of post-release criminal behavior records. The recidivism literature recognizes that the FBI offender “RAP” sheets are the most accurate and readily available data source for repeat criminal behavior. However, “RAP” sheets can contain errors or partial information. For example, “RAP” sheets only contain information on offenses for which offender fingerprints were obtained. Additionally, depending on the reporting policies and practices of local jurisdictions, arrest dispositions may not always be transferred to the FBI for inclusion on “RAP” sheets. “RAP” sheets will under report actual criminal

¹¹This figure represents the sum of the sample offenders who by June 1, 2001, were still in prison (8.9%) or who had died (0.4%).

¹²The percentage of offenders in each CHC who were released from prison and met the two year window inclusion conditions are: CHC I–91.3 percent; CHC II–85.6 percent; CHC III–83.7 percent; CHC IV–80.9 percent; CHC V–73.8 percent; and CHC VI–49.6 percent.

¹³Disposition information was obtained from the FBI’s criminal history record (“RAP sheet”).

behavior, and will under report convictions resulting from arrests. For this reason, recidivism studies (including all of the Commission’s previous recidivism study reports) commonly cite recidivism rates separately for what is termed here the “primary” and “re-conviction” definitions. However, these same studies also argue that, compared to the “re-conviction” definition, the “primary” recidivism definition is a more reliable and valid measure for the probability of actual re-offending because of its inclusiveness and its high association with actual re-offending.¹⁴ Also, because these two definitions are strongly correlated, the research findings resulting from analyses using the two definitions are similar and lead to nearly identical conclusions, although the magnitude of their comparative findings differs.

C. Methodology

In this study, three techniques are used to analyze recidivism rates of federal offenders. The three techniques are tabular analysis, area measurement under the receiver operating characteristic curve, and survival analysis with hazard modeling. All three are accepted methods for evaluating recidivism. By using all three methods, the Commission is able to show the degree to which the criminal history components predict recidivism.¹⁵

Tabular analyses provide “yes” or “no” rates of recidivism for offender characteristics. For example, exhibits in this report compare recidivism rates across many characteristics, such as gender (male rates versus female rates) or educational level (those without high school diplomas, those graduating high school, or those with college). Tabular analyses permit straightforward comparison between characteristics, but can be misleading. They do not provide information about intervening influences that may in fact mitigate or enhance an association. For example, if offenders of one race are more likely to finish high school than are offenders of another race, the confounding effects of race and level of education cannot be separated from a tabular analysis. In essence, tabular analyses cannot claim that race determines or causes the educational achievement. Tabular analyses simply show whether offenders of a particular race are more likely to finish high school. In other words, tabular analyses do not explain *why* some people of a particular race are more likely to finish high school.

Measuring the area under the curve (AUC)¹⁶ is an established technique associated with receiver operating characteristic curve analysis. It provides the probability that the offender’s prior criminal history is able to predict who does recidivate and who does not. The AUC statistic ranges from a value of 0.5 (indicating no predictive power for recidivism) to a value of 1.0 (indicating 100

¹⁴Spohn and Holleran, 2002. The methodological arguments supporting various empirical definitions of recidivism are contained in the companion project report, “Background and Methodology of the U.S. Sentencing Commission’s 2003 Recidivism Study.”

¹⁵Quinsey, Harris, Rice, and Cormier, 1998; Swets, Dawes, and Monahan, 2000.

¹⁶The AUC methodology is summarized in Appendix A, with a detailed explanation in the project’s companion report, “Background and Methodology of the U.S. Sentencing Commission’s 2003 Recidivism Study.”

percent accuracy in predicting recidivism). The greater the AUC statistics, the better is the predictive power of the prior criminal history model.

The third method used to evaluate recidivism in this study, survival analysis,¹⁷ makes a further important contribution. Survival analysis measures the ability of criminal history to predict how rapidly offenders recidivate during a follow-up period. An important strength of survival analysis is its ability to incorporate explanatory variables into the prediction model, thus measuring the statistical significance of their independent effects on recidivism.

The analysis below uses all three of these methodological techniques to present and evaluate the current predictive power of the guidelines' current Criminal History Category (CHC) and criminal history point measures.

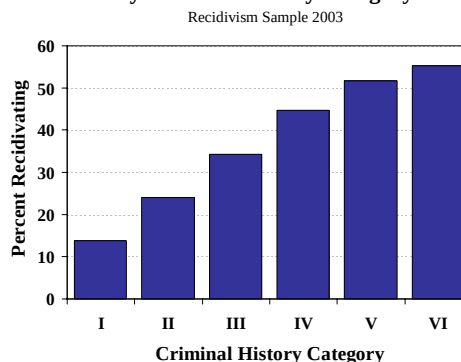
D. Recidivism Prediction Results

The sections below present the recidivism prediction statistics for the guideline criminal history measures. The analysis uses recidivism data tabulations, survival analysis, and AUC outcomes for both the CHC and criminal history point measures. Exhibits 2 through 8 cited in this section appear at the end of the report.

1. Criminal History Category

Exhibit 2 (located at the end of the report) presents the guidelines' recidivism rates by CHC for both the primary and re-conviction recidivism definitions. The sidebar graphic to the right displays the numerical data of Exhibit 2 for the primary recidivism definition. Recidivism risk increases with each CHC: guideline offenders in higher CHCs are more likely to re-offend within two years of release from prison or upon entering probation status. Under the primary recidivism measure, offenders in CHC I have a substantially lower risk of recidivating within two years (13.8%) than do offenders in CHC VI (55.2%).

**Percent Recidivating Within Two-Years (Primary Definition),
by Criminal History Category**



SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. citizens), 2003, weighted data.

¹⁷The survival (or hazard modeling) methodology is summarized in Appendix B, with a detailed explanation in the project's companion report, "Background and Methodology of the U.S. Sentencing Commission's 2003 Recidivism Study."

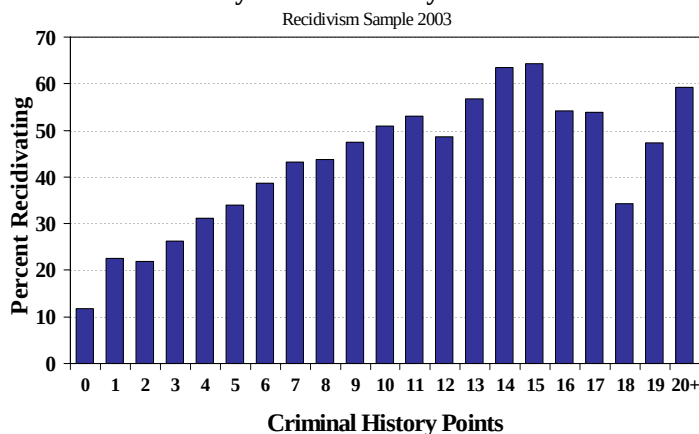
Exhibit 3 focuses on the three components of the primary recidivism definition and illustrates the distribution of recidivating activity type.¹⁸ The level of recidivism under each individual primary recidivism definition element is proportional across the CHCs. Supervision violations are the largest type of recidivism behavior, accounting for an average 45 percent of recidivism across the CHCs. Arrests without known conviction dispositions account for an average 33 percent of recidivism events across the CHCs. Finally, new offense re-conviction accounts for an average 22 percent of recidivism events across the CHCs. Similar proportions of behavior types across the CHCs suggest that the results from a recidivism analysis conducted on any one recidivism element alone will produce results similar to those obtained using the combined three elements of the primary recidivism definition.¹⁹

2. Criminal History Points

Exhibit 4 appears at the end of the report, but its data are displayed in the sidebar graphic to the right. The data reflect the primary recidivism definition. Offenders with 20 or more criminal history points are all grouped into the last category. As the data in Exhibit 4 illustrate, approximately 0.9 percent of offenders in the recidivism study have 20 or more criminal history points.

Criminal history points represent the purest form in which the guidelines measure recidivism risk. The CHC is not as pure in its form because the CHC is an aggregation of points into one of only six categories. Therefore, the sum of criminal history points is the primary source for evaluating the predictive ability of the current criminal history Chapter Four provisions. Not surprisingly, therefore, when predicting the primary

**Percent Recidivating Within Two Years (Primary Definition),
by Criminal History Points**



SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. citizens), 2003, weighted data.

¹⁸Recall that the three components of the primary recidivism definition are: a re-conviction; a re-arrest with no conviction disposition information available on the post-release criminal history record; and a supervision revocation (during either probation or post-prison supervision).

¹⁹However, analysis using only one of the three primary definitions components is not recommended. Using only one element of the definition reduces the sample size of recidivating offenders, which subsequently increases the rate of error in the indicator chosen to measure the underlying risk for re-offending. Further, analysis using only one recidivism event type (re-convictions only, for example) may find that certain predictors are not statistically significant both because one event type provides a lower base rate for recidivism and because one event type will provide a more error prone measure of the underlying risk for re-offending.

measure of recidivism, criminal history points also perform well.²⁰

Recidivism rates for number of criminal history points also follow the upward positive linear slope trend seen with the recidivism rates of the CHCs. In general, as the number of criminal history points increases, the risk of recidivating within two years increases.

3. Survival Analysis

This subsection of the report focuses on survival analysis methodology and its recidivism findings. Exhibit 5 displays cumulative survival curves for the first two years at risk by CHC.²¹ One way to conceptualize this methodology is to imagine federal offenders in the community at risk of committing a recidivating act. As time passes, one or another offender recidivates. The longer the time at risk, the greater the total number of offenders recidivating. A line drawn over time would slope upward to the right, thereby showing the cumulative percent of offenders who had recidivated by each day. This “survival curve” graphs the cumulative probability over time of offenders recidivating. The curves from the recidivism survival analysis have a distinct advantage in showing what happens over each day during the two year follow-up period and the total cumulative percent of each CHC who have recidivated at any point in time.

The survival curves in Exhibit 5 show the cumulative percentage of offenders recidivating in each CHC for each day, starting with the first day at risk. For example, for CHC II offenders at one year (365 days), approximately 13.4 percent had recidivated or conversely, 86.6 percent had *not* recidivated, during the first year (365 days) at risk in the community. Visually following the CHC II’s survival curve past 365 days, the curve continues to slope upward. By two years (730 days) the percentage of CHC II offenders recidivating increases to 24.0 percent – almost doubling the rate from the one-year time point for those in CHC II.

The survival curve data in Exhibit 5 show the same pattern of recidivism rates as observed of Exhibit 2. Recidivism rates are lowest in CHC I and rise for each increasing CHC. However, two findings from the survival analysis are noteworthy.

The first noteworthy finding is the striking similarity of the proportional rate increases from CHC I through CHC V. The ratio of the survival curve lines is almost constant: the lines on their graph appear nearly equally spaced as they fan out over the number of days from one to 730. This

²⁰Observed deviations from linearity may be due to insufficient sample size or the correlation of recidivism with other variables not included in criminal history points(e.g., age or gender).

²¹The survival (or hazard modeling) methodology is summarized in Appendix B, with a detailed explanation in the project’s companion report, “Background and Methodology of the U.S. Sentencing Commission’s 2003 Recidivism Study.” The recidivism survival curves presented in Exhibit 5 were generated using a proportional hazard model with the primary recidivism measure regressed on dummy variables representing each of the CHCs. CHC I is the comparison category. This method is described by several experts on survival modeling: Allison 1995; Hosmer and Lemeshow 1999; and Klein and Moeschberger 1997.

“stepping stone” appearance suggests that the first five CHCs clearly delineate recidivism risk by CHC.

A second noteworthy finding is the almost nonexistent difference between the survival curves of CHC V and CHC VI. The lines lie nearly on top of each other, although they do begin to diverge slightly (with CHC VI rates slightly higher) after approximately 600 days at risk.

Statistical tests²² for differences between the CHCs confirm the visual analysis. The difference in predictive accuracy between CHC V and CHC VI is not statistically significant,²³ while the differences between the other categories are statistically significant.²⁴ The statistical results of this modeling are reported in the appendix, and specify that there is no significant difference between CHC V and CHC VI in predicting recidivism. This finding is, however, somewhat misleading, because offenders sentenced under the career offender guideline (§4B1.1) and the armed career criminal guideline (§4B1.4) can be assigned to criminal history category VI, even if they have fewer than 13 criminal history points, the minimum number of points otherwise needed for an offender to be placed in category VI. Approximately 145 offenders in the weighted recidivism two year follow-up sample had fewer than 13 criminal history points, but were assigned to criminal history category VI for sentencing. When the hazard model using criminal history categories predicting days until recidivism was rerun for criminal history categories assigned based only on criminal history points, the statistical tests show that all categories are significantly different from one another, including categories V and VI. The results indicate that category VI offenders have higher recidivism rates than offenders in category V. In sum, it appears that assigning offenders to criminal history category VI, under the career criminal or armed career criminal guidelines, is for reasons other than their recidivism risk. The survival analyses described here will be explored further in forthcoming papers.

4. Area Under the Curve (AUC) Analysis

Earlier, in this report’s methodology section, an introduction to AUC analysis appears. The AUC method reports prediction power strength²⁵ for a given criminal history measure, and also permits comparisons of prediction power over alternative measures. This subsection of the report presents the recidivism prediction power of the CHC and of the sum of criminal history points. Analyses for both the primary and re-conviction definitions appear.

²²In this statistical analysis, CHC I is used as the comparison category.

²³ $p < 0.05$

²⁴ $p < 0.05$

²⁵Here the AUC statistic technically provides the probability that a prior criminal history measure (i.e., the CHC itself, or the sum of criminal history points) for a randomly selected recidivist will be greater than the same measure for a randomly selected non-recidivist. In the discussion, such a significant relationship is referred to as recidivism prediction.

AUC Criminal History Category Predictions

Exhibit 6 shows the AUC curve generated using the CHC measure to predict the primary recidivism definition within a two year follow-up. The AUC is 0.6786, which is significantly ($p < 0.05$) different from the random model.²⁶ It is clear that the CHC measure is a significantly better predictor of recidivism than chance.

AUC Criminal History Points Predictions

As discussed earlier, criminal history points are the underlying pure measure of the guidelines' Chapter Four computation. The criminal history points are aggregated into the CHCs, and in so doing, would be expected to lose some of the precision in their predictive power. Therefore, it is appropriate to examine criminal history points as the better predictor of recidivism when assessing Chapter Four's predictive power.

To gauge criminal history points' predictive ability, Exhibit 7 graphically displays the AUC analysis for the recidivism measure of criminal history points. Again, the AUC analysis predicts recidivism during the first two years at risk. The AUC is 0.6992, which is a statistical ($p < 0.05$) improvement over the random model. The conclusion is that the current criminal history points measure is a predictor of recidivism risk. As expected, however, note that the AUC for CHC (0.6786 from Exhibit 6) is less than the AUC for criminal history points (0.6992 from Exhibit 7). This ordering indicates that the criminal history points measure is more predictive²⁷ and demonstrates that information regarding recidivism risk is indeed lost when criminal history points are converted into CHCs.

E. Summary of Recidivism Prediction Results

Both CHCs and criminal history points predict recidivism, regardless of whether recidivism is measured with the primary definition or by a re-conviction only definition. Exhibit 8 summarizes the prediction for the four empirical groupings that result from two recidivism definitions (primary recidivism measure and re-conviction recidivism measure) and two criminal history measures (CHC and criminal history points). All four combinations statistically predict recidivism and result in the same analytical conclusions.

However, the most predictive result occurs when criminal history points are the measure used to predict the primary recidivism measure. The AUC for this combination is the highest, at 0.6979. This finding confirms the expectation that the criminal history points measure represents

²⁶The random model defines the likelihood of recidivism at 50 percent – similar to tossing a coin.

²⁷Statistical tests show that the ROC for criminal history points is significantly larger at the .05 level than criminal history categories when predicting the primary recidivism measure.

the most accurate predictive instrument. Recall also that the primary recidivism definition has been shown to be the more statistically error free measure of recidivism, minimizing prediction errors.²⁸

The analysis indicates that criminal history points have a greater prediction power than do the CHCs. However, the difference in predictive power does not argue for the abandonment of the CHC axis of the sentencing table. Even though the prediction power difference between the two criminal history measures is significant, the CHC provides a simplicity and efficiency that argues for its continued use in the sentencing process. The absolute level difference of prediction power may have a statistically significant import, but the difference is, in fact, relatively small and justifies the practical significance of only a small handful of CHCs.

F. Recidivism and Offender Characteristics

The sections below summarize the variation in recidivism rates based on offender characteristics. The tabular analyses show association between characteristics, but do not imply causation. The recidivism rate patterns observed are typical of those reported in most prior federal offender recidivism research,²⁹ and reveal associations potentially relevant to policy discussions concerning the guidelines' criminal history measures. Exhibits 9 through 13 cited in this section appear at the end of the report.

1. Gender

Overall, women recidivate at a lower rate than men. Exhibit 9 depicts the percentage of male and female offenders who recidivate within two years of returning to the community. Of the males in the study sample, 24.3 percent recidivate, 75.7 percent do not. Of the females in the study sample, 13.7 percent recidivate, 86.3 percent do not. Again, the rates for males and females increase in the higher CHCs. The difference between male and female rates, however, is not constant. In CHC I through CHC IV, there is never greater than approximately a five percentage point difference between male and female rates. However, in CHC V and CHC VI, the difference between the rates jumps to approximately 15 percentage points.

²⁸Errors in recidivism prediction occur when a model predicts recidivism for an offender and in fact the offender does not recidivate (a Type I error, denoted as α), or when a model does not predict recidivism for an offender and in fact the offender does recidivate (a Type II error, denoted as β). The advantages of the primary recidivism measure in minimizing Type I and Type II errors is discussed in a recidivism project companion report, "Background and Methodology of the U.S. Sentencing Commission's 2003 Recidivism Study."

²⁹Harer 1994.

2. Age at Sentence

Recidivism rates decline relatively consistently as age increases. Generally, the younger the offender, the more likely the offender recidivates. Exhibit 9 illustrates the age recidivism trend of the study sample. Among all offenders under age 21, the recidivism rate is 35.5 percent, while offenders over age 50 have a recidivism rate of 9.5 percent.

3. Race and Ethnicity

Exhibit 9 illustrates that the race of the offender is associated with recidivism rates. Overall, Black offenders are more likely to recidivate (32.8%) than are Hispanic offenders (24.3%). White offenders are the least likely to recidivate (16.0%).

4. Employment Status

Exhibit 10 shows that those with stable employment in the year prior to their instant offense are less likely to recidivate (19.6%) than are those who are unemployed (32.4%). The difference between the employed and unemployed recidivating declines in the higher CHCs, until offenders in CHC VI have virtually the same recidivism rate regardless of their employment status in the year prior to their instant offense.

5. Educational Attainment

Exhibit 10 shows recidivism rates for offenders with different educational backgrounds. Overall, offenders with less than a high school education are most likely to recidivate (31.4%), followed by offenders with a high school education (19.3%), offenders with some college education (18.0%), and offenders with college degrees (8.8%). One exception is seen in CHC V where recidivism rates for offenders with a college education (73.3%) are higher than rates for offenders with less than a high school education (50.6%).

6. Marital Status

Offenders who have never been married are most likely to recidivate (32.3%), as shown in Exhibit 10. Those who are married are slightly less likely to recidivate (13.8%) than are those who are divorced (19.5%).

7. Illicit Drug Use

Exhibit 10 demonstrates a relationship between illicit drug use and recidivism. Overall, offenders using illicit drugs within one year prior to their instant offense have a higher recidivism rate (31.0%) than those not using illicit drugs (17.4%). This finding does not hold for CHC V offenders.

8. Guideline Instant Offense Level

There is no apparent relationship between the sentencing guideline final offense level and recidivism risk. Exhibit 11 illustrates the percentages of offenders who recidivated within each offense level grouping. The recidivism rates are essentially the same, regardless of the offender's offense severity under the sentencing table. This relationship is consistent with the principle that the guideline offense level is not designed to predict recidivism, while the criminal history computation is designed to predict recidivism.

9. Guideline Applied for Instant Offense

Exhibit 11 relates the recidivism rate and the guideline driving the sentence for the instant offense. Overall, offenders sentenced under the guidelines for robbery, §2B3.1 (41.2%) and firearms, §2K2.1 (42.3%) are most likely to recidivate. Offenders sentenced in fiscal year 1992 under fraud, §2F1.1 (16.9%), larceny, §2B1.1 (19.1%), and drug trafficking, §2D1.1 (21.2%) are overall the least likely to recidivate. Noteworthy data are seen in the patterns across the CHCs. Even though fraud and larceny offenders had lower recidivism rates in CHC I and II, the recidivism rates for these offenses exceed 50 percent in CHC V and CHC VI and appear sometimes comparable to the recidivism rates for robbery and firearms at the higher CHCs. Additionally, except in CHC I, drug trafficking offenders have the lowest, or second lowest, rate of recidivism across the CHCs.

10. Sentence Type: Probation, Alternatives, or Prison

Exhibit 12 reports that, overall, offenders are most likely to recidivate (25.6%) when their sentence is a straight prison sentence. Recall that straight prison sentences fall within Zone D of the sentencing table,³⁰ with greater instant offense seriousness implicit. Of those offenders sentenced to a probation only sentence, 15.1 percent recidivate. Offenders serving a sentence of probation combined with confinement alternatives have a similar rate of 16.7 percent.

³⁰Zone D in the sentencing table of Chapter Five Part A requires that, absent departure, the minimum sentence term be satisfied with a sentence of imprisonment (§5C1.1(f)). In contrast, sentence terms in Zones B and C can be satisfied in part with alternative confinement, and sentence terms in Zone A do not require confinement nor imprisonment. Within any given CHC, the sentence terms of guideline ranges in Zone D have the greatest length in the sentencing table, ranging from offense levels 13 and higher for CHC I, to offense levels 6 and higher for CHC V.

11. Length of Sentence Imposed for Instant Offense

Exhibit 12 displays the relationship between the length of the instant offense prison sentence and recidivism rates. The overall trend shows that recidivism has an “inverted U” shape. Recidivism is comparatively low for the lowest sentences (less than six months, or probation), peaks with mid-length sentences (lengths of roughly six months to two years) and then drops for the longest sentences.³¹ Among the individual CHCs, however, no discernable trend emerges, although “inverted U” shapes are recognizable in CHC III, CHC V, and CHC VI. Note that for some CHCs, offenders spending “0” time in prison (i.e., probation only or probation with alternative confinement alternatives) have comparatively high recidivism rates. In fact, in CHC I, CHC III, CHC V, and CHC VI, the recidivism rates for “0” prison lengths are often higher than those of offenders who received a minimum prison sentence (one to six months).

12. Departure Status

Panel three of Exhibit 12 displays recidivism rates of offenders by departure status. Overall, offenders receiving a substantial assistance departure have the lowest recidivism rate (17.9%). Recidivism rates for sentences within the guideline range and downward departure sentences are similar (23.3% and 23.0%, respectively). Looking at differences among the CHCs themselves, only the lower CHCs (I, II, III, and IV) have the lowest recidivism rates in substantial assistance departure cases. Downward departure offenders only in the higher CHCs (III, IV, V, and VI) have recidivism rates below the rates for within guideline offenders.

13. Type of Recidivating Event

Exhibit 13 uses a different format from the preceding exhibits. The exhibit reports the distribution of first recidivating events in each CHC. The exhibit addresses the kinds of events that constitute recidivism, and provides this information for all offenders and for each separate CHC.

Overall, probation revocations account for the highest percentage (20.8%) of recidivating events. Across all recidivating offenders, one in five committed a probation violation. However, this finding is in part an artifact of the guideline sentencing structure. There are greater numbers of offenders in the lower CHCs, and those in the lower CHCs are more likely to receive a non-prison sentence, and thus be under probation supervision. It is not surprising, therefore, that only for CHC I, CHC II, and CHC III are probation revocations the most common recidivating events.

For similar reasons, supervision revocations, which are overall the second most frequent recidivating offenses, are the *most* frequent recidivating events for CHC IV, CHC V, and CHC VI.

³¹Recall the discussion in section A, noting that due to their typically longer prison confinements, fewer of the offenders sampled from the higher CHCs had been released and included in the presented statistics. Follow-up recidivism studies that include more offenders with longer sentences may uncover relationships that differ from those observed at this time.

Those in the higher CHCs are more likely to receive a prison sentence, and thus be under supervised release when returning to the community.

Among the non-supervision re-offending events, almost one in every ten events is a violent crime, and their frequency is comparable across the CHCs. Drug trafficking crimes comprise almost nine percent (8.8%) of recidivating events, with their likelihood decreasing from 11.2 percent in CHC I to 4.1 percent in CHC VI. In contrast, larceny rates increase from a low of 6.9 percent in CHC I to a high of 14.9 percent in CHC VI.

G. Conclusion

Testing of the guidelines' criminal history measure's predictive power shows that the aggregate Chapter Four provisions are performing as intended and designed. Recidivism rates rise as criminal history points increase and as CHCs increase. The empirical evidence shows that criminal history as a risk measurement tool has statistically significant power in distinguishing between recidivists and non-recidivists. Not surprisingly, criminal history points predict better than the CHC. This is because points comprise the raw criminal history calculation. The CHC measure sums the number of points into aggregate categories. For example CHC III contains offenders with four, five, or six criminal history points. It is logical that the points themselves are more predictive than the summed measure. However, the statistically significant difference in prediction between the points and sum measures may not have policy significance. The practical and efficiency advantages of having a small set of CHCs in the sentencing table overwhelm the small absolute increase in predictive power.

The findings in this analysis suggest a number of additional topics that will be addressed in the companion reports from the recidivism project. One example focuses on offenders with minimal prior criminal history. Not only do they have substantially lower recidivism rates, but they are considered less culpable under the guidelines. Possible sentencing reductions for "first offenders" are supported by the recidivism data and would recognize their lower re-offending rates. At the other end of the scale, this analysis finds no statistical difference between the recidivism rates of offenders in CHC V and CHC VI. One conclusion is that these two categories could be combined with no loss of predictive power. Even with equal recidivism rates, however, practitioners and policy makers may identify a culpability difference between offenders in CHC V and CHC VI. Such a culpability distinction might argue for maintaining these two different CHCs.

The recidivism rates associated with offender or offense characteristics also highlight important relationships. One such relationship concerns offense seriousness and recidivism. There is no correlation between recidivism and guidelines' offense level. Whether an offender has a low or high guideline offense level, recidivism rates are similar. While surprising at first glance, this finding should be expected. The guidelines' offense level is not intended nor designed to predict recidivism. Other sets of interesting relationships are those between prior illicit drug use and recidivism, or offender education level and recidivism. If, as the data indicate, abstinence from illicit drug use, or high school completion, reduces recidivism rates, then rehabilitation programs

to reduce drug use or to earn high school diplomas may have high cost-benefit values. Even further, the relationships between recidivism rates and instant offense types are noteworthy. Robbery and firearms offenders have overall higher recidivism rates compared to fraud, larceny, or drug trafficking offenders. However, in the higher CHCs, the recidivism rates for larceny and fraud offenders reach levels almost comparable to the rates for robbery and firearms offenders.

Investigations using the recidivism data suggest that there are several legally permissible offender characteristics which, if incorporated into the criminal history computation, are likely to improve predictive power. Analyses in the recidivism project's report series address the rationale and value of various proposals to modify the current Chapter Four computation in order to increase predictive power. Offender age³² is a pertinent characteristic. Data from this report indicate that younger offenders are more likely to recidivate than older offenders. Indeed, the U.S. Parole Commission's recidivism predictor, the salient factor score, does incorporate offender age, thus improving its predictive power. A companion report from the recidivism project explores this issue in detail and compares the predictive power of the salient factor score with the guidelines' Chapter Four computation.



³²USSG Ch. 4, Pt. A, intro. commentary states that some explanatory variables, such as age and drug abuse, were not incorporated into Chapter Four as recidivism predictors because of policy concerns. However, the guidelines leave open their possible later consideration, stating that the factors were “not included here at this time.”

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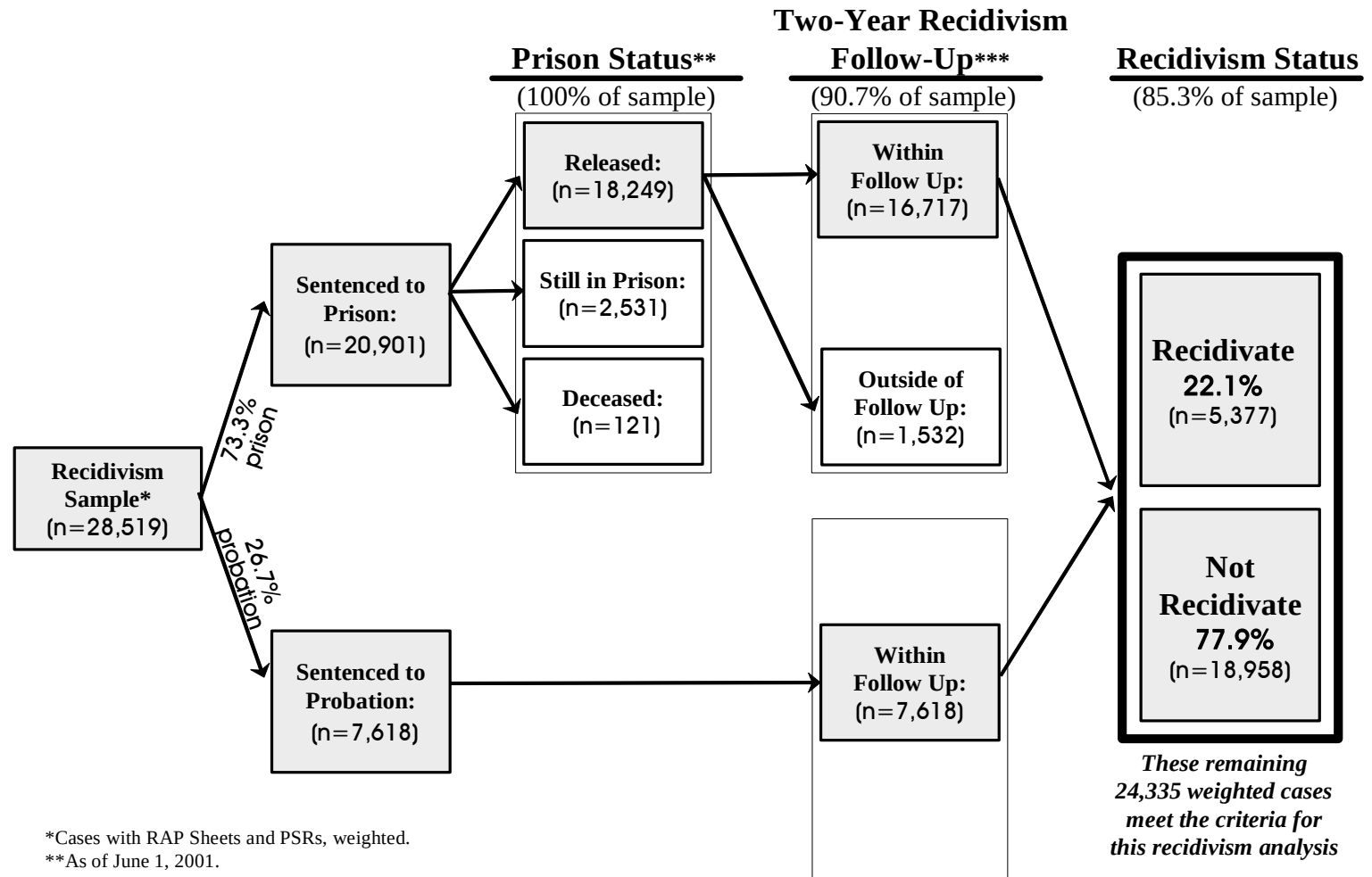
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Exhibit 1
Chronological Flow Chart of Recidivism Sample
 Recidivism Study 2003



*Cases with RAP Sheets and PSRs, weighted.

**As of June 1, 2001.

***End of two year recidivism window of opportunity is June 1, 2001.

Source: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 2
**Recidivism Rates, by Criminal History Category for
Primary and Re-Conviction Recidivism Definitions**
Recidivism Study 2003

CRIMINAL HISTORY CATEGORIES							
	Total Percent Recidivating	Category I Percent Recidivating	Category II Percent Recidivating	Category III Percent Recidivating	Category IV Percent Recidivating	Category V Percent Recidivating	Category VI Percent Recidivating
TOTAL¹	24,335	15,429	2,857	2,844	1,359	779	1,067
Primary Recidivism Definition²							
Did Recidivate	22.1	13.8	24.0	34.2	44.6	51.6	55.2
Did <i>NOT</i> Recidivate	77.9	86.2	76.0	65.8	55.4	48.4	44.8
Re-Conviction Recidivism Definition³							
Did Recidivate	6.3	4.0	8.1	9.0	11.5	14.5	14.9
Did <i>NOT</i> Recidivate	93.7	96.0	91.9	91.0	88.5	85.5	85.1

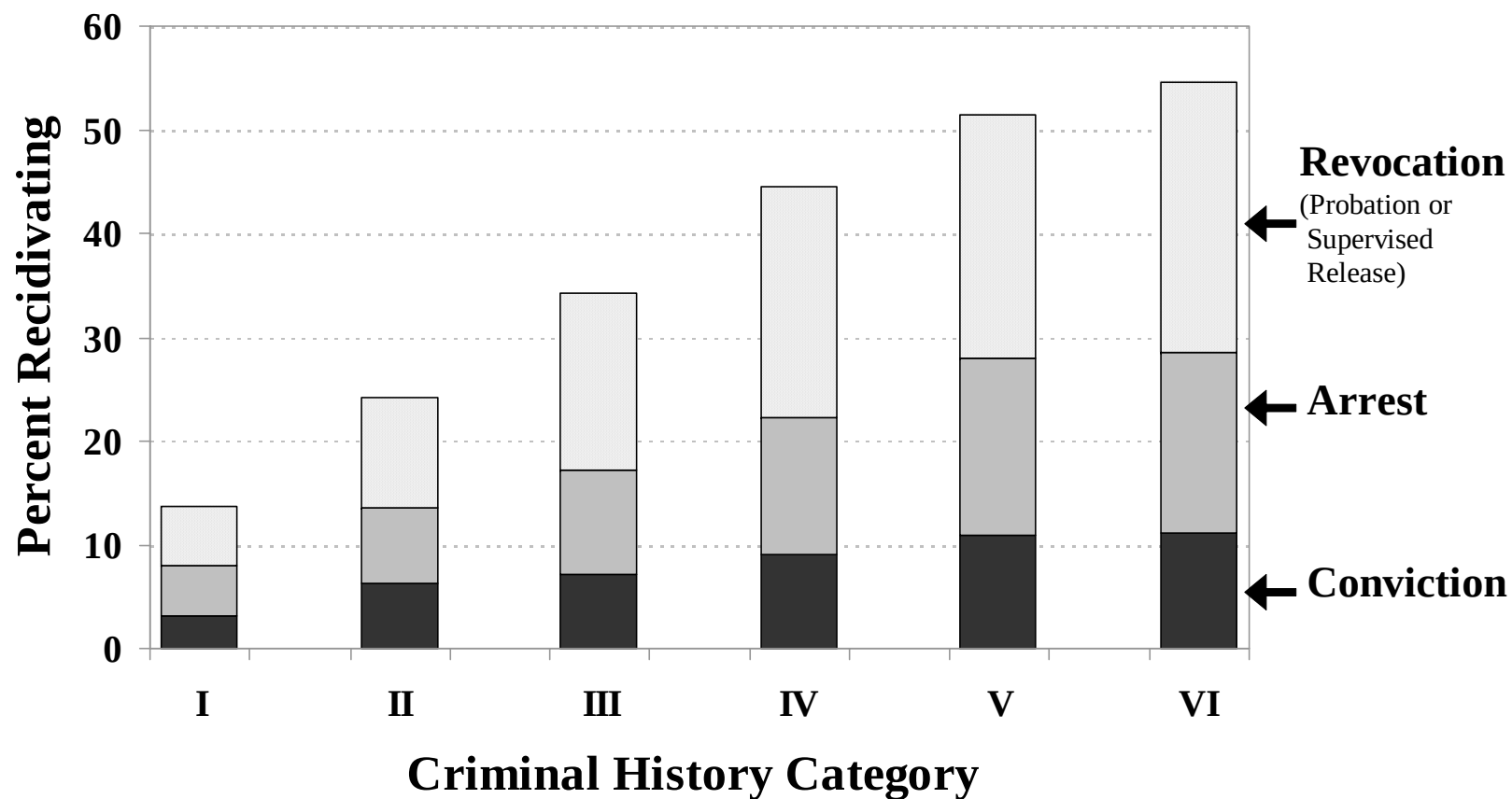
¹ Number of offenders with a 24 month period at risk of recidivating following either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

² Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

³ Re-conviction recidivism definition based solely on the offender's re-conviction, excluding any supervised release/ probation violations or re-arrests.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 3
**Two Year Primary Recidivism Measure Components,
by Criminal History Category**
Recidivism Study 2003



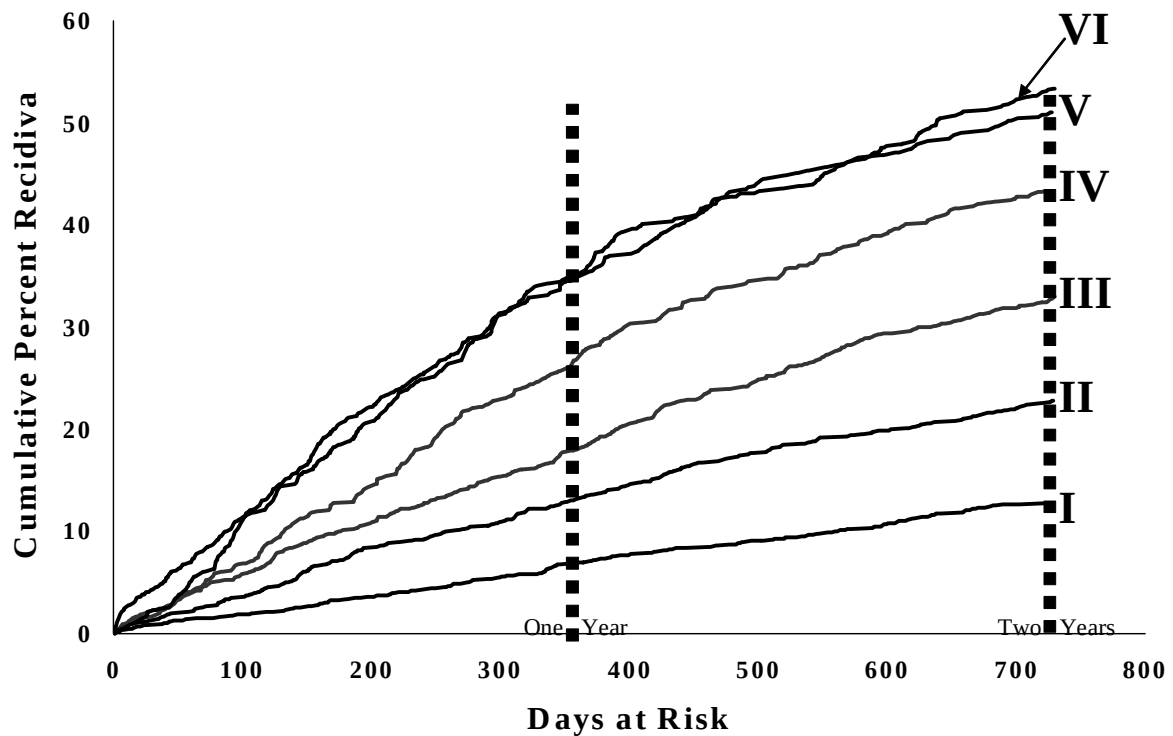
SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. citizens), 2003, weighted data.

Exhibit 4
Two Year Recidivism Rates for Number of Criminal History Points:
Primary and Re-conviction Recidivism Definitions
 Recidivism Study 2003

Number of Criminal History Points	N	Percent Recidivating <i>Primary Definition</i>	Percent Recidivating <i>"Re-conviction" Definition</i>
TOTAL	24,335	22.1	6.3
0 points	12,562	11.8	3.6
1 point	2,888	22.5	5.5
2 points	1,274	21.9	7.5
3 points	1,552	26.2	8.5
4 points	1,141	30.2	8.7
5 points	847	34.0	9.6
6 points	921	38.7	8.7
7 points	499	43.3	12.6
8 points	464	43.7	10.5
9 points	431	47.5	11.2
10 points	300	50.9	13.7
11 points	279	53.1	14.0
12 points	249	48.7	14.0
13 points	131	56.8	12.0
14 points	139	63.4	18.1
15 points	136	64.3	18.6
16 points	87	54.2	19.3
17 points	80	53.9	19.7
18 points	73	34.3	11.5
19 points	60	47.4	3.5
20 points or more	222	59.3	18.5

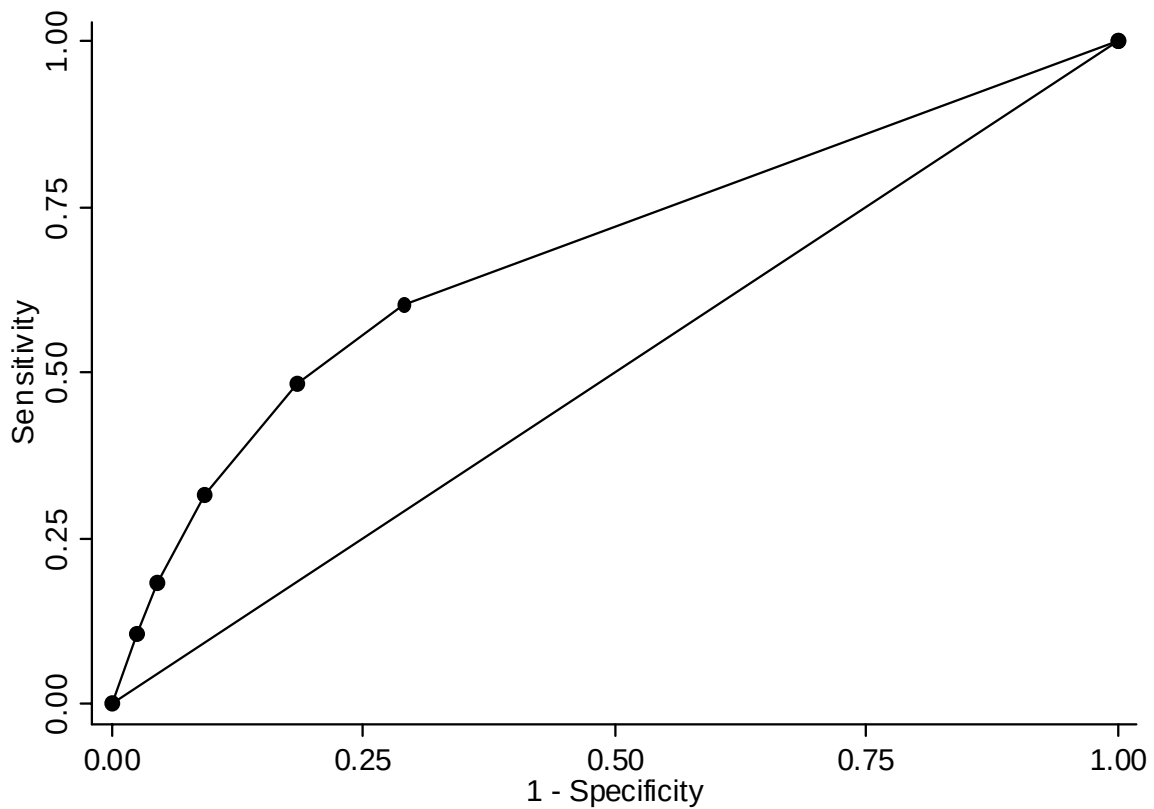
SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data. Missing data are excluded, unless specified.

Exhibit 5
Two Year Cumulative Recidivism Rates:
Primary Recidivism Definition
 Recidivism Study 2003



SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. citizens), 2003, weighted data.

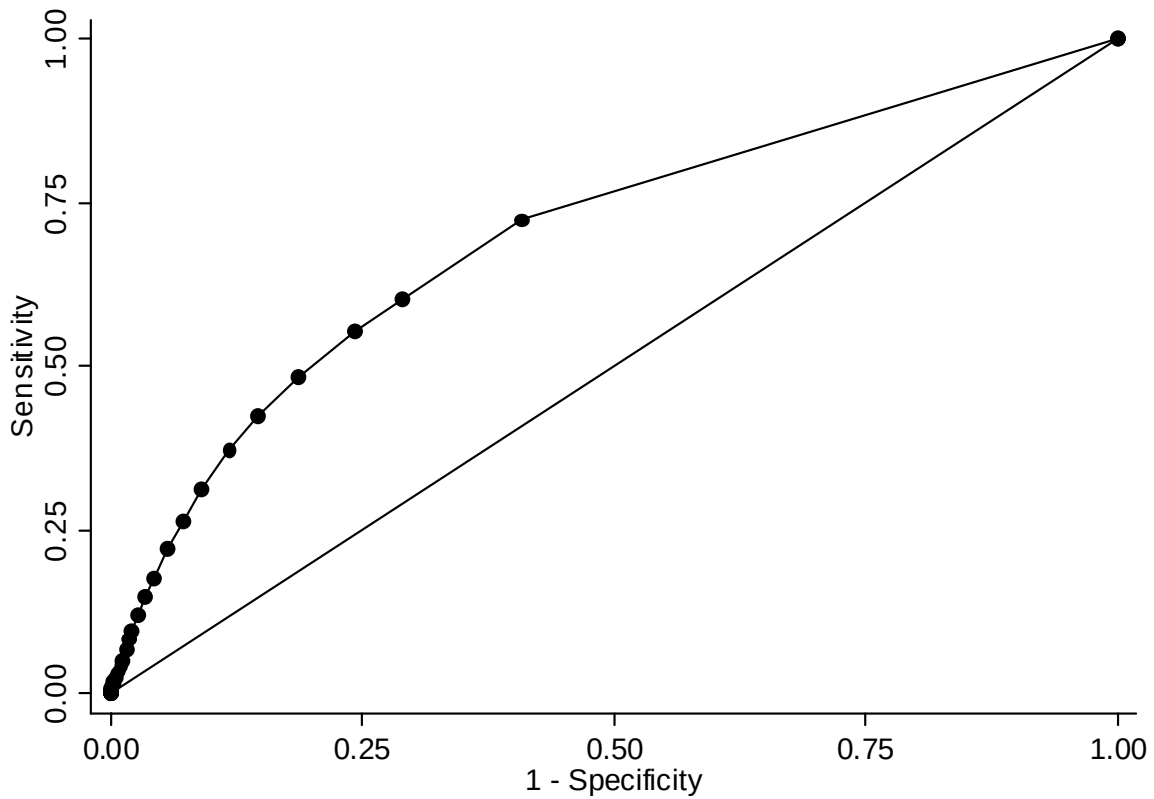
Exhibit 6
Criminal History Category:
ROC Curve for Two Year Primary Recidivism Definition
Recidivism Study 2003



ROC Area = 0.6786
Standard Error = 0.0041
95% Confidence Interval = 0.67064 to 0.68657

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 7
Criminal History Points:
ROC Curve for Two Year Primary Recidivism Definition
Recidivism Study 2003



ROC Area = 0.6992
Standard Error = 0.0041
95% Confidence Interval = 0.69113 to 0.70721

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 8
Summary of Predictive Power of Current Criminal Measures:
Criminal History Category and Criminal History Points
 Two Year Statistics Using Different Recidivism Definitions
 Recidivism Study 2003

Instrument and Recidivism Definition	Area Under Curve (AUC)	95% Confidence Interval	Standard Error
Primary Recidivism Definition			
Criminal History <i>Category</i> Measure	0.6786*	(0.6706, 0.6866)	0.0041
Criminal History <i>Points</i> Measure	0.6992*	(0.6911, 0.7072)	0.0041
Re-Conviction Recidivism Definition			
Criminal History <i>Category</i> Measure	0.6396*	(0.6256, 0.6537)	0.0072
Criminal History <i>Points</i> Measure	0.6510*	(0.6366, 0.6654)	0.0073

*Significantly different from 0.5 at $p < 0.05$.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 9
Primary Definition Recidivism Rates¹ for General Demographic Variables, by Criminal History Category
Gender, Age at Sentencing, and Race
 Recidivism Study 2003

CRIMINAL HISTORY CATEGORIES

Demographic Characteristics	Total Percent Recidivating	Category I Percent Recidivating	Category II Percent Recidivating	Category III Percent Recidivating	Category IV Percent Recidivating	Category V Percent Recidivating	Category VI Percent Recidivating
TOTAL²	24,335	15,429	2,857	2,844	1,359	779	1,067
Gender							
Female	13.7	10.0	23.6	30.7	40.0	36.8	39.0
Male	24.3	15.2	24.1	34.7	45.0	52.8	56.3
Age at Sentence							
Under 21	35.5	29.5	35.6	54.7	64.3	60.1	55.0
21 – 25	31.9	22.3	29.1	42.7	55.1	70.1	68.1
26 – 30	23.7	13.3	27.3	33.6	43.9	53.1	58.8
31 – 35	23.8	14.6	22.7	32.7	42.7	50.8	59.3
36 to 40	19.7	12.1	23.2	29.4	33.1	40.0	51.3
41 to 50	12.7	6.9	13.3	24.5	45.3	35.7	41.3
Over 50	9.5	6.2	13.9	19.8	21.0	57.1	41.1
Race							
White	16.0	8.9	18.9	27.8	42.8	46.8	50.9
Hispanic	24.3	18.9	22.9	36.0	28.1	47.0	57.8
Black	32.8	23.7	31.4	41.6	48.0	55.6	60.7
Other ³	26.4	15.5	35.9	58.3	39.6	100.0‡	57.1

¹ Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

² Number of offenders with a 24 month period at risk of recidivating following either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

³ "Other" race category includes Native Americans and Asians.

‡ Indicates fewer than 10 sample subjects. Findings may not be statistically significant.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 10
Primary Definition Recidivism Rates¹ for General Demographic Variables, by Criminal History Category
Employment, Education, Marital Status, and Illicit Drug Use
 Recidivism Study 2003

CRIMINAL HISTORY CATEGORIES

Demographic Characteristics	Total Percent Recidivating	Category I Percent Recidivating	Category II Percent Recidivating	Category III Percent Recidivating	Category IV Percent Recidivating	Category V Percent Recidivating	Category VI Percent Recidivating
TOTAL²	24,335	15,429	2,857	2,844	1,359	779	1,067
Employment Status³							
Unemployed	32.4	20.6	26.8	39.4	48.0	53.0	54.5
Employed	19.6	12.7	23.3	32.1	43.1	50.8	55.7
Educational Attainment⁴							
Less Than High School	31.4	21.3	31.3	38.5	49.8	50.9	59.5
High School	19.3	10.6	21.8	32.5	40.1	53.5	52.6
Some College	18.0	13.9	17.8	29.0	39.0	45.6	50.0
College Graduate	8.8	7.1	6.5	18.5	34.6	73.3	36.5‡
Marital Status							
Never Married	32.3	22.7	32.3	44.6	46.9	56.8	57.9
Legal Marriage	13.8	9.8	13.9	25.1	40.0	41.3	52.7
Divorced	19.5	9.8	23.3	27.2	44.0	40.1	51.1
Other ⁵	22.9	12.9	23.1	31.4	45.1	62.0	55.7
Illicit Drug Use⁶							
No Illicit Drug Use	17.4	10.8	21.2	31.5	40.2	53.5	53.7
Illicit Drug Use	31.0	21.9	27.5	37.6	49.6	49.8	56.7

¹ Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

² Number of offenders with a 24 month period at risk of recidivating following either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

³ Employment status during the year prior to the instant offense. "Employed" includes alternative forms of employment and "Unemployed" includes missing values.

⁴ Educational Attainment at the time of the instant offense.

⁵ "Other" marital status category includes "Co-habiting," "Widowed," and "Separated."

⁶ Illicit drug use during the year prior to the instant offense. Missing values counted as "No" illicit drug use.

‡ Indicates fewer than 10 sample subjects. Findings may not be statistically significant.

Exhibit 11
Primary Definition Recidivism Rates¹ for Instant Offense Characteristics, by Criminal History Category
Instant Offense Level and Primary Sentencing Guidelines
 Recidivism Study 2003

Offense Characteristics	CRIMINAL HISTORY CATEGORIES						
	Total	Category I	Category II	Category III	Category IV	Category V	Category VI
	Percent Recidivating	Percent Recidivating	Percent Recidivating	Percent Recidivating	Percent Recidivating	Percent Recidivating	Percent Recidivating
TOTAL²	24,335	15,429	2,857	2,844	1,359	779	1,067
Instant Offense Level							
01 – 08	22.5	15.1	29.8	37.6	44.1	54.6	62.4
09 – 10	22.5	9.6	18.3	45.4	51.0	54.4	60.6
11 – 12	21.7	8.7	38.0	39.1	50.8	52.2	52.0
13 – 16	22.2	14.8	23.5	37.4	39.5	50.8	58.1
17 – 21	27.3	17.5	25.7	37.5	44.1	59.6	59.6
22 – 25	22.8	13.3	22.5	33.3	40.3	34.9	61.6
26 – 30	20.7	18.9	19.7	19.2	39.5	43.8	41.4
31 – 43	17.5	11.1	12.2	22.4	30.6	46.2	39.9
Primary Sentencing Guideline							
§2D1.1 (<i>drug traf.</i>)	21.2	16.7	19.8	26.1	37.7	48.1	43.8
§2F1.1 (<i>fraud</i>)	16.9	9.3	26.3	33.8	42.3	51.2	53.4
§2B1.1 (<i>larceny</i>)	19.1	11.6	37.9	56.6	43.0	57.4	58.0
§2K2.1 (<i>firearms</i>)	42.3	23.7	26.8	44.1	53.0	54.2	63.4
§2B3.1 (<i>robbery</i>)	41.2	33.7	31.4	38.8	57.1	45.2	70.3
All Other Guidelines	20.5	12.6	23.6	34.0	44.3	53.7	55.1

¹ Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

² Number of offenders with a 24 month period at risk of recidivating following either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

³ The sentence imposed for the offender's instant offense, presented in months.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 12
Primary Definition Recidivism Rates¹ for Instant Offense Characteristics, by Criminal History Category
Type of Sentence, Length of Sentence, and Departure Status
 Recidivism Study 2003

Offense Characteristics	CRIMINAL HISTORY CATEGORIES						
	Total Percent Recidivating	Category I Percent Recidivating	Category II Percent Recidivating	Category III Percent Recidivating	Category IV Percent Recidivating	Category V Percent Recidivating	Category VI Percent Recidivating
TOTAL²	24,335	15,429	2,857	2,844	1,359	779	1,067
Type of Sentence							
Fine Only	1.2	0.0‡	0.0‡	0.0‡	100.0‡	0.0‡	0.0‡
Probation Only	15.1	12.7	21.8	36.4	42.9	64.7	57.1‡
Probation + Alternatives	16.7	13.3	29.4	37.2	44.1	73.3	58.3‡
Prison + Alternatives	18.3	12.1	26.3	32.5	57.1	50.0	58.3
Prison Only	25.6	14.8	23.6	34.0	44.2	50.8	55.1
Length of Sentence³							
0	15.7	12.8	25.2	36.8	44.4	68.8	57.7
01 – 05	14.3	7.4	32.7	31.2	66.7	55.6	25.0‡
06 – 11	27.1	17.2	25.0	45.5	42.3	64.0	57.7
12 – 23	28.4	16.5	27.2	40.4	51.0	50.7	61.0
24 – 59	26.8	14.0	22.9	34.4	44.6	51.3	57.3
60 or More	22.7	15.1	19.1	22.3	36.6	46.7	49.7
Departure Status							
Within Guideline	23.3	14.6	25.5	37.0	45.8	51.7	56.8
Upward Departure	27.8	0.0‡	14.3‡	22.2	44.4	57.1	57.1
Substantial Asst.	17.9	11.5	19.0	24.7	40.2	57.7	51.8
Other Downward	23.0	16.7	27.3	29.8	39.2	30.5	54.4

¹ Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

² Number of offenders with a 24 month period at risk of recidivating following either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

³ The sentence imposed for the offender's instant offense, presented in months.

‡ Indicates fewer than 10 sample subjects. Findings may not be statistically significant.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Exhibit 13
Offenders' Recidivating Offense Under the Primary Recidivism Definition,¹
by Criminal History Category
 Recidivism Study 2003

CRIMINAL HISTORY CATEGORIES

	Total Percent	Category I Percent	Category II Percent	Category III Percent	Category IV Percent	Category V Percent	Category VI Percent
TOTAL PERCENT	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Recidivating Offense Type²							
Probation Rev.	20.8	24.1	21.8	20.8	17.8	14.7	15.2
Supervision Rev.	18.6	14.0	17.4	19.6	25.1	26.7	23.1
Fraud	4.8	5.9	5.1	5.1	2.5‡	2.1‡	4.0
Drug Possession	5.6	5.2‡	2.6‡	8.8	4.5	6.4	5.5
Drug Trafficking	8.8	11.1	9.3	7.4	7.6	6.7	4.1
Larceny	7.7	6.9	8.0	5.6	5.7	9.5	14.9
DUI	4.9	6.1	6.0	5.0	2.3‡	2.8‡	3.1
Serious Violent Offense ³	11.7	9.6	13.5	12.2	16.3	10.8	12.5
Other	17.1	17.1	16.3	15.5	18.2	20.3	17.6
	(N=5,377) ⁴	(N=2,128) ⁴	(N=687) ⁴	(N=974) ⁴	(N=606) ⁴	(N=400) ⁴	(N=582) ⁴

¹ Primary recidivism definition based on offender's re-arrest, including supervised release/ probation violations, re-arrest, or re-conviction.

² Offense types only for offenders' who had a first recidivism event during the 24 month recidivism follow-up period after either initiation of probation (for offenders receiving probation-only sentences) or release from confinement (for those offenders receiving confinement sentences).

³ "Serious Violent Offense" category includes re-arrests for the following offense types: homicide, kidnaping, robbery, sexual assault, aggravated assault, domestic violence, and weapon offenses.

⁴ Number of offenders who recidivated in the given CHC.

‡ Indicates fewer than 10 sample subjects. Findings may not be statistically significant.

SOURCE: U.S. Sentencing Commission, FY1992 Recidivism Sample (U.S. Citizens), 2003, weighted data.

Appendix A

Evaluating Predictive Power with the Area Under the Receiver Operating Characteristic Curve

Determining the area under a specific geometric curve is an established technique for measuring the predictive power of a measurement instrument. This technique is well established in diagnostic testing for health disorders when a procedure is used to determine the presence of a disease. If the diagnostic test accurately predicts the presence of the disease, this is a “true positive” result. However, the researcher must also know how often a diagnostic test indicates that a disease is present when in fact the disease is not present. This type of prediction error is called a “false positive” result. The best prediction tool maximizes true positives and minimizes false positives.³³ The technique that analyzes prediction accuracy uses a graph that maps the “true positive” rate against the “false positive” rate. The curve of this graph is called a receiver operating characteristic (ROC) curve. The area under the curve provides a measure of the predictive power of the prediction instrument. The paragraphs below illustrate how this technique is used.

ROC analysis is a straightforward application of this technique to recidivism research. Here the measurement instrument is the offender’s prior criminal history. For this example, assume that the instrument measures criminal history points. The points are used to predict recidivism. The analysis must show how often the measure of criminal history points accurately predicts recidivism, compared to how often the measure of criminal history points predicts recidivism incorrectly.

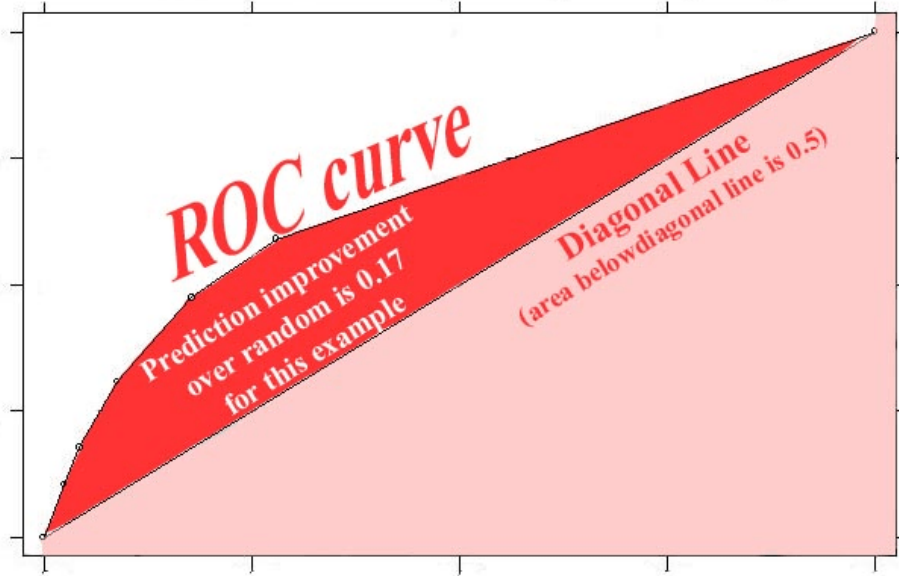
Graphically, the data is shown in a rectangular box with the area being one unit, as shown in the figure below. A diagonal line is drawn from the lower left to the upper right corners, bisecting the rectangle into two equal parts. The area below the diagonal line measures one half the area of the box (i.e., 0.5 units) and represents “random” prediction, or no predictive power at all. Any observation along the diagonal line is equally likely to be a true positive or a false positive. This line, and the area of the rectangle below it, is the comparison point for the recidivism model.

When the observed true positive and false positive recidivism data are plotted in this rectangular box,³⁴ they form a line that curves upward from the diagonal line. This curved line is the ROC curve. The higher the ROC line curves above the diagonal line (and toward the top and left side of the rectangle), the greater the area under its curve. The area under the ROC curve represents the predictive power of the criminal history model. Because the ROC curve is higher than the

³³This is a simplified explanation. For the sake of clarity, additional issues involving “true negatives” and “false negatives” are not considered.

³⁴On the graph, the false positive rate is plotted along the x axis and the true positive rate (called the “sensitivity”) is plotted along the y axis. The false positive rate is defined as 1 minus the specificity.

Area under the Receiver Operating Curve (ROC) = 0.67



diagonal line, the area under the ROC curve is greater than the area under the diagonal line. Thus, as represented in the figure, the ROC curve improves upon random chance prediction.

The statistic used to measure the predictive power of the criminal history model is the “AUC”: the Area Under the Curve. The greater the AUC, the better the predictive power of the measurement instrument.

The AUC has several desirable qualities as a prediction power gauge. First, and in the context of prior criminal history predicting recidivism, the AUC is interpreted as the probability that a randomly chosen known recidivist will have more prior criminal history than a randomly chosen known non-recidivist. Therefore, the AUC ranges from 0.5 to 1.0.

- With an AUC of 0.5, a randomly chosen known recidivist has a 50 percent chance of having more prior criminal history than a randomly chosen non-recidivist. This would mean that there is no relationship between recidivism and prior criminal history.
- With an AUC of 1.0, 100 percent of the randomly chosen recidivists will have more prior criminal history than the randomly chosen non-recidivists, meaning that prior criminal history predicts recidivism perfectly. With an AUC of 1.0, all recidivists would have more prior criminal history than all non-recidivists.

AUCs between 0.5 and 1.0 indicate a “better than random” predictive accuracy, but a “less

than perfect” predictive accuracy. For the hypothetical example appearing in the figure above, the AUC of 0.67 indicates that 67 out of 100 times, randomly chosen recidivists and non-recidivists are compared, a recidivist would have more prior criminal history than a non-recidivist. This indicates that while the extent of prior criminal history is a strong predictor of recidivism, it is not a perfect predictor. The prediction power of a criminal history measure might be improved by adding or changing its components. However, both legal and policy factors guide the types of characteristics that can be part of a prediction model.³⁵

The AUC statistic has three additional desirable properties. It is insensitive to the base rate of recidivism. It can be used across multiple predictive instruments to compare statistically significant prediction power differences.³⁶ Finally, the AUC can be graphically represented allowing visual comparisons among multiple curves calculated from different prediction instruments.



³⁵The introductory comments of USSG Ch.4, Pt. A states that “while empirical research has shown that other factors are correlated highly with the likelihood of recidivism, e.g., age and drug abuse, for policy reasons they were not included here at this time.”

³⁶Hanley and McNeil, 1982; Hanley and McNeil, 1983, DeLong, DeLong, and Clarke-Pearson, 1988. The ability to compare different criminal history models makes AUC an important tool in assessing impacts of changes to the guidelines’ Chapter Four provisions.

Appendix B

Evaluating Predictive Power with Survival Analysis

Survival analysis, also called hazard rate analysis, is a method that can be used to evaluate the predictive ability of the guidelines' criminal history measure. Survival analysis measures the ability of criminal history to predict how rapidly offenders recidivate during the follow-up period.³⁷ The concept of crimes committed per unit of time has its roots in the incapacitation literature, where great effort was expended to identify offenders who committed crimes frequently. These repeat offenders were individuals committing multiple crimes in a given period, such as daily, monthly, or yearly. By identifying frequent offenders, they could be targeted for longer prison terms than offenders who commit crimes less frequently. Incapacitation literature argues that the selective targeting of frequent offenders would result in a more efficient use of prison resources as a means of crime reduction.

Survival analysis is used here to examine how well criminal history predicts the number of crimes offenders will commit during a specific follow-up period. The example below illustrates its strengths.

Assume a researcher has recidivism data for 200 offenders who were released from prison all on the same day. Assume that all 200 offenders recidivate during the first two years back in the community.

- The first 100 of the offenders all recidivate on the last day of the two year follow-up, the 730th day. Thus, 100 crimes were committed on day 730. The daily rate of crime for this group is 100 crimes divided by 730 days, or 0.1370 offenses per day.
- The second 100 of these offenders all recidivate on the first day of the follow-up period. Thus, 100 crimes were committed on day one. The daily rate of crime for this group is 100 crimes divided by one day, or 100 offenses per day.

These two groups have different speeds of offending. Within 730 days, the first group is expected to commit 100 crimes. During the same 730 day period, however, the second group is expected to commit 73,000 crimes (assuming, of course, that none are apprehended).

Although an extreme example, it illustrates the concern of crime control advocates with respect to their goal of protecting the public. This approach argues that criminal history must have

³⁷Allison, 1995; Hosmer and Lemeshow, 1999; Klein and Moeschberger, 1997.

the predictive power to identify offenders who pose a greater risk to public. Survival analysis allows for this evaluation of the prior criminal history measures.

Survival analysis and the AUC³⁸ provide different perspectives on recidivism risk. The AUC measures how well prior criminal history predicts whether offenders recidivate or not during a fixed follow-up period. Given the 100 percent rate of recidivism for both groups in the example, the AUC would be identical when using criminal history to predict recidivism separately for each group of offenders. The AUC is not sensitive to the speed at which offenders recidivate and therefore, does not gauge how well criminal history predicts the frequency of re-offending.

In contrast, survival models are sensitive to the speed of recidivism and therefore provide a way to test how well criminal history measures this important aspect of re-offending risk. The survival curves in Exhibit 5 show, from a survival analysis perspective, the rapidity of recidivism for each day of the two year follow-up period, for each of the six CHCs (I through VI). Offenders in CHCs V and VI recidivate most rapidly and therefore if not apprehended, are likely to offend more frequently during the two year follow-up period than are offenders in CHC I.

Survival analysis has another advantage over the AUC when used to evaluate criminal history's ability to predict recidivism. Multiple regression methods for survival analysis have been developed that allow simultaneous evaluation of the independent contribution to predictive power of the various criminal history components.³⁹ The proportional hazard model estimates presented below test whether each individual CHC contributes uniquely when predicting the rapidity of recidivism. As discussed in the report, CHCs I, II, III, and IV have independent and significant effects on predicting recidivism. However, the impact of CHC V and CHC VI are not statistically different. This finding is, however, somewhat misleading, because offenders sentenced under the career offender guideline (§4B1.1) and the armed career criminal guideline (§4B1.4) can be assigned to criminal history category VI, even if they have fewer than 13 criminal history points, the minimum number of points otherwise needed for an offender to be placed in category VI. Approximately 345 offenders in the weighted recidivism two year follow-up sample had fewer than 13 criminal history points, but were assigned to criminal history category VI for sentencing. When the hazard model using criminal history categories predicting days until recidivism was rerun for criminal history categories assigned based only on criminal history points, the statistical tests show that all categories are significantly different from one another, including categories V and VI. Results indicating that category VI offenders have higher recidivism rates than offenders in category V. In sum, it appears that assigning offenders to criminal history category VI, under the career criminal or armed career criminal guidelines, is for reasons other than their recidivism risk. The survival analyses described here will be explored further in forthcoming papers.

³⁸AUC denotes the Area Under the Curve analysis from the ROC curve, described in Appendix A.

³⁹Companion reports in the recidivism project series perform these analyses such as, whether the guideline provision of "recency points" (§4A1.1(e)) adds significantly to predictive power over and above other criminal history components.

Proportional Hazard Model Estimates for Criminal History Category Variables

Two Year Primary Recidivism Definition
Each CHC is analyzed as a binomial variable with Category I as the Comparison Category.

Statistical Tests for Differences Between Criminal History Category Dummy Variable Coefficients

Variable	Parameter Estimate	Standard Error	Pr > ChiSq	Hazard Ratio
CAT_II	0.62261	0.04613	<.0001	1.864
CAT_III	1.04420	0.04024	<.0001	2.841
CAT_IV	1.38747	0.04410	<.0001	4.005
CAT_V	1.61343	0.05522	<.0001	5.020
CAT_VI	1.68928	0.04796	<.0001	5.416
Likelihood Ratio	2131.0946		<.0001	

Hypotheses Tests for Equality between Successive Criminal History Category Coefficients

Label	Wald Chi-Square	DF	Pr > ChiSq
CAT_II = CAT_III	64.0514	1	<.0001
CAT_III = CAT_IV	46.5174	1	<.0001
CAT_IV = CAT_V	12.7208	1	0.0004
CAT_V = CAT_VI	1.3180	1	0.2510

