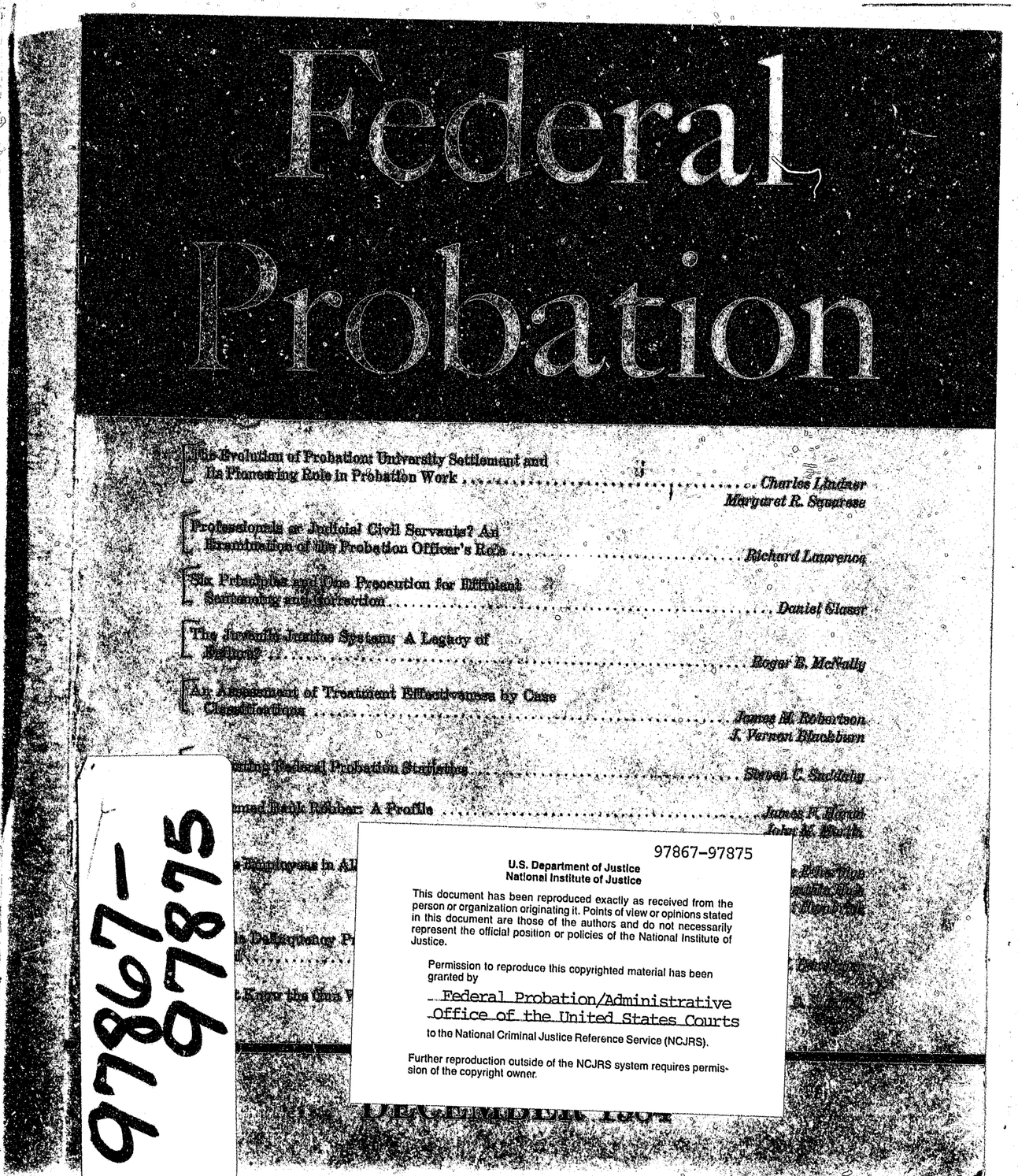

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This Issue In Brief

The Evolution of Probation: University Settlement and Its Pioneering Role in Probation Work.—In the final article of a series of four on the evolution of probation, authors Charles Lindner and Margaret Savarese further explore the link between the settlement movement and the beginnings of probation in this country by focusing on one particular settlement, the University Settlement Society of New York City. Close examination of the University Settlement papers revealed that this settlement, during the late 1890's and early 1900's, expanded its programs and activities to meet the growing needs of the people of the Lower East Side and became very much involved in probation work at the same time. This involvement included experimentation with an informal version of probation prior to the passage of the first probation law in New York State, the appointment of a settlement resident as the first civilian probation officer immediately following passage of this law, the creation of a "probation fellowship" sponsored by one of the settlement benefactors, and the description of this probation work in various publications of the day.

Professionals or Judicial Civil Servants? An Examination of the Probation Officer's Role.—A major issue and question in the probation field is whether probation officers are professionals. In this study, Richard Lawrence examines whether probation officers see themselves as professionals and the extent to which they experience role conflict and job dissatisfaction. The study also looks at how probation officers perceive their roles in relation to the judicial process and the services provided to probationers. Three factors were found to make a difference in officers' role preference and whether they experience role conflict: size of their department (and city), age, and years of experience. A number of recommendations are offered to give probation officers equal professional status with judicial personnel and more autonomy to exercise their professional skills in the court organization.

Six Principles and One Precaution for Efficient Sentencing and Correction.—According to author Daniel Glaser, more crime prevention per dollar in sentencing and correction calls for: (1) an economy principle of maximizing fines and minimizing in-

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carceration; (2) noncriminalization of offenders who have strong stakes in conformity; (3) crime-spree interruption; (4) selective incapacitation; (5) reducing inmate pressures from other inmates and increasing staff and outsider influences; (6) appropriate vocational training of offenders. These goals require avoidance of sentences based purely on just deserts.

The Juvenile Justice System: A Legacy of Failure?—In a follow-up to his previous article, "Juvenile Court: An Endangered Species" (*Federal Probation*, March 1983), author Roger B. McNally expands the notion that the juvenile justice system is on the brink of extinction. The author identifies five contemporary themes which are jeopardizing the very existence of juvenile justice and strongly suggests that if the present course of events goes unabated, this system—by the turn of the century—may be recorded in the annals of history as a legacy of failure and a system that self-destructed. The article identifies the *need* for a separate system of justice by citing examples of failure when the adversarial model is applied to juvenile matters. The author maintains that the juvenile justice system is at a crossroad which requires an affirmation rather than a condemnation of the notion that youth are more than "short adults" necessitating incapacitation until they "grow-up."

An Assessment of Treatment Effectiveness By Case Classifications.—Authors James M. Robertson and J. Vernon Blackburn studied the effects of treatment upon probationers by formulating three questions which asked if court-ordered treatment had any effect on the revocation percentage of probationers in the minimum, medium, and maximum supervision categories as established by four major base expectancy scales. Summarized, the treatment group had lower revocation percentages in 10 out of 12 supervision categories. These results led to positive conclusions regarding the effects of treatment in reducing probation failures.

Forecasting Federal Probation Statistics.— The procedures used in forecasting Federal probation population totals are explained with the intention of making these techniques available to the individual probation office. Author Steven C. Suddaby discusses long- and short-term projections and difficulties which are peculiar to probation forecasting.

The Armed Urban Bank Robber: A Profile.—An analysis of 500 armed bank robbers revealed that they do not fit the stereotype of sophisticated professional criminals, say authors James F. Haran and John M. Martin. Rather, these robbers are a cohort of young adult, unattached, socially disorganized males, predominately black, poorly educated, and lacking vocational skills; most are unemployed, previously arrested property offenders. Twenty-five percent are drug addicts. They make little profit from their crimes, are swiftly arrested, and receive long jail sentences. A fourfold typology of offenders is developed based on career patterns of prior property crime offenses. The authors propose that selective sentencing, focused more on the career pattern rather than the crime, might render a more effective sentencing formula.

Female Employees in All-Male Correctional Facilities.—Court decisions have opened the doors for women to work in male corrections, but the real struggle to find acceptance and promotion within the system is just beginning. According to authors Rose Etheridge, Cynthia Hale, and Margaret Hambrick, this struggle takes place within the parameters established by inmate, staff, and community attitudes and the attitudes and motivations of the woman herself. Images of women developed long before the working relationships color her interactions with inmates and staff. The authors stress that the woman must understand what is happening and use specific coping strategies if she wants to succeed.

Juvenile Delinquency Prevention and Control in Israel.—The number of youth committing serious crimes in Israel is reaching alarming proportions. After discussing the scope and dimensions of the delinquency problem in Israel, author Gad J. Bensinger describes the Israeli juvenile justice system and explains the prevention and control strategies of the police, the courts, and the juvenile probation department. Although law enforcement and delinquency prevention was never a national priority in Israel, a reallocation of resources may be required to meet the new domestic needs.

I Didn't Know The Gun Was Loaded.—The judgment of criminal intent has become formalized in Western law as a way of appreciating more fully the nature and quality of an unlawful act and, implicitly, assessing the character and social fitness of the accused. However desirable in theory, the evidential determination of intent, a subjective phenomenon, may pose complex problems. Author James D. Stanfiel proposes a revised concept of criminal intent, one less heavily dependent upon rational choice as a precondition of legal accountability.

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The Evolution of Probation

University Settlement and its Pioneering Role in Probation Work*

BY CHARLES LINDNER AND MARGARET R. SAVARESE**

ALTHOUGH THE settlement movement originated in England with the founding of Toynbee hall in 1884, the underlying settlement idea was quickly appropriated by a small band of young, energetic Americans and transported to the United States. Here, it took hold and spread so rapidly that by the turn of the century, there were more than 100 settlement houses, of all types and descriptions, most of them located in the largest, most heavily populated urban centers.

There were many similarities between the English social settlement movement and its American cousin. Both had come about as a response to the ever-growing tide of urbanization and industrialization, and both were envisioned as one possible remedy for the social rifts and disorganization which inevitably accompanied these two processes. Thus, the settlement movement on both sides of the Atlantic attempted to repair these rifts and "sought to reconcile class to class, race to race, and religion to religion."[1] The English and American settlement movements were also very much alike in that both tended to attract clergymen, professors, writers, and, more than anyone else, young men and women eager to serve their fellow man in some socially useful way. In America, the pioneering settlement residents were, invariably, not only young but also well-educated, usually with some post-graduate training, from solidly middle or upper-class backgrounds, and of old, Anglo-Saxon, Protestant stock.

In addition to the similarities, there were also differences between the English and American versions of the settlement movement. Unlike their English counterparts which were often church-affiliated, most of the American settlements were deliberately nonsectarian and devoid of any formal adherence to doctrine or ritual, although the individual founders and leaders were often deeply religious themselves. An even more significant difference was the involvement of many of the American settlements in a wide variety of reform measures designed to improve the lot of the thousands of impoverished immigrants who were pouring into the already congested, tenement neighborhoods. Their continuous day-to-day presence in these neighborhoods brought the early settlement residents face-to-face with a bewildering array of problems that cried out for attention and amelioration and turned many of them into political activists. Jane Addams, of Hull House, touched on just a few of the problems which galvanized settlement residents into fighting for social change when she wrote:

> Insanity housing, poisonous sewage, contaminated water, infant mortality, the spread of contagion, adulterated food, impure milk, smoke-laden air, ill-ventilated factories, dangerous occupations, juvenile crime, unwholesome crowding, prostitution, and drunkenness are the enemies which the modern city must face and overcome would it survive.[2]

Thus, settlement workers became deeply involved in a broad range of reform activities aimed at eliminating these conditions, and one of the many reform measures which attracted their support was an innovation known as probation. The active role played by a number of very influential settlement leaders in helping probation become an accepted practice has been virtually ignored, although the part they played was a truly critical one. This article continues to explore the link between the settlement movement and the beginning probation movement by focusing on one particular settlement, University Settlement of New York City, and by examining its active involvement and support of probation during its infancy around the turn of the century.

The Early Years of University Settlement

University Settlement, which went on to become one of the most influential of all the settlements, began rather inauspiciously, as the Neighborhood Guild, in a dilapidated tenement on the Lower East Side of Manhattan. The founder was Stanton Coit, a moody, idealistic intellectual who had spent some

*This is the final article in a series of four.

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[1] Clarke Chambers, *Seedtime of Reform: American Social Service and Social Action, 1918-1933*. Minneapolis: University of Minnesota Press, 1963, p. 14.

[2] *Ibid.*, p. 16.

marized, were that the treatment group had lower revocation percentages in 10 out of 12 of the supervision categories. One of the two exceptions proved to be on a base expectancy scale which did not predict risk for this particular population. From these results positive conclusions were reached regarding the effects of treatment in reducing probation failures.

The outcome of this study offers support to the continued use of treatment in the U.S. Probation System. However, the methods of determining who is treated is an area which was found in need of further study.

Also this study did not examine the nature or frequency of treatment, and these factors could have a bearing on treatment effectiveness. However, this would be very difficult to examine. The modality and number of brokered treatment contacts are not recorded, only a summary of progress. In spite of the difficulties, efforts should be made to segregate contacts into treatment categories along with a recording process for brokered services. Once record-keeping has been corrected to account for these factors, further study should be conducted to determine if frequency or nature of treatment has any bearing on success or failure.

The limited population this study examined due to time and circumstance is a temporary problem. Further studies will be conducted on the larger populations created by the passage of time. The data base will be increased each year to gain significantly greater numbers than were available for this study.

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Forecasting Federal Probation Statistics

BY STEVEN C. SUDDABY*

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FORECASTS OF several measures of workload in the Federal Probation System form the basis for the system's budget each year. These workload measures include the numbers of pre- and post-sentence investigations, collateral investigations, and miles traveled, among others, but the most important measure is the number of persons under supervision. To arrive at a final forecast for persons under supervison, it is useful to also forecast the numbers of persons received for and removed from supervision. This article will explain the process I use in forecasting these statistics with the intent that these methods can be used in individual probation offices (Federal, state, or county) to project their own workload 1 or 2 years into the future. General considerations in forecasting and problems specific to probation data and these forecasts will be discussed.

This is written first for the individual in the probation office who has some, but not extensive, statistical training. The nontechnical parts of this article will be useful to the manager who has to understand forecasts prepared by others. He or she would want to read from the beginning through the first four paragraphs of the section "The Forecasting Models," then the last three paragraphs of that same section, and finally the section "General Forecasting Considerations" through the end of the article. It isn't possible to give a complete course in forecasting in one short article, but I hope to cover most of the main issues.

It's assumed that you have available a computer and a statistical software package so that you can compute multiple regression equations, since it just isn't practical to do a multiple regression with more than two predictor variables without a computer. Because a computer with software is assumed, I won't be repeating here a number of equations which only the computer needs to know. If you don't have a computer available, you might want to consider the suggestions in the very last paragraph of this article before deciding the article can't be of help to you.

*The author gratefully acknowledges the comments made on an earlier draft of this article by Dr. David L. Farnsworth, Eisenhower College, and Ms. Elizabeth A. McGrath, Administrative Office of the U.S. Courts.

Because the forecasting models given are developed for predicting national probation caseloads, it won't be possible for you to just copy them verbatim for use in your own district. My intention instead is to suggest variables which are useful for predicting the size of probation caseloads and to give you enough information about forecasting in general to make forecasts on your own.

The Forecasting Models

A "model" in the mathematical sense is an equation or group of equations which duplicates conditions in the real world. We are trying to create models which will tell us how many people will be under supervision in 2 years given a particular set of circumstances now. The most important feature of this forecast of persons under supervision is that there are several forecasts which are used to arrive at a final forecast. The forecasts from the different models are averaged, or one of them is chosen as being better than all of the others. Using multiple regression, I've created two models for forecasting persons under supervision, one for persons received, and two for persons removed. Two more projections for persons under supervision can be created by using the projections for persons received and removed to calculate the number under supervision. This is done by starting with the number of Persons Under Supervision at the end of the year, adding to that the forecast of Persons Received, and subtracting from that sum one of the forecasts for Persons Removed.

Predictor variables, also known as independent variables, are those variables which are useful for predicting. For example, the number of cars registered in a state would be a good predictor variable for the number of fatal accidents in that state. Records might show over the years that the number of cars divided by 100,000 estimates the number of fatal accidents fairly well. This will work even though not all accidents involve cars registered in that state. For example, if the percentage of fatal accidents which involves trucks, buses and out-of-state vehicles is fairly constant over the year, the number of cars registered in the state will be a good predictor variable for fatal accidents. You'll notice

that all of the predictor variables discussed below come from court or probation system data; law enforcement agency or prison data are not used. Court data are useful because anyone who enters the Federal probation system must enter the court system as a criminal defendant, but the same could be said about law enforcement agency data. I use court data instead of any other data out of personal preference because it is easily available to me and because I am familiar enough with the courts to be able to forecast the predictor variables if necessary. In your particular situation, prison or law enforcement agency data might be more useful to you, and you should not overlook these potential sources for good predictor variables.

Each of the variables used to forecast persons received for, removed from, or under supervision is lagged at least 1 year. For example, a good predictor of the number of persons received for supervision in 1985 might be the number of defendants sentenced to 2 years of prison in 1984 (since most won't serve 2 years).[1] In using the historical data to define the relationship between these two variables, "persons received" in a particular year is always compared to the "number sentenced" in the previous year. The variable "number sentenced" is said to be *lagged* 1 year behind the variable "persons received." If predictor variables were used that were not lagged, then it would be necessary to forecast the predictor variable itself in order to forecast "persons received," and nothing would be gained by using a predictor.

Another procedure which needs explaining is that of using the *square* of a predictor variable in addition to using the variable itself. A regression model estimates the linear relationship[2] between predictor variables and the variable that is to be forecasted. If the relationship between a predictor variable and the variable to be forecasted is not linear, then a regression model which does not take this into account will estimate the relationship poorly and give a poor forecast. Without going into too many details, one way to handle this is by subtracting the mean of the predictor variable from each of the values of that predictor variable. This results in some positive and some negative numbers. These numbers are then squared, and the squared numbers are used as an additional predictor variable. How to recognize when this procedure is necessary will be discussed later.

1. Persons Received

The multiple regression model which forecasts the number of persons received for supervision has five predictor variables (interdistrict transfers are not counted as receipts). This will forecast 1 year ahead without having to forecast the predictor variables. These are:

IMPR21 – The number of persons sentenced to imprisonment for 13 through 35 month terms. The 2 in the abbreviation refers to a roughly 2-year term. The 1 indicates that the number sentenced is lagged back 1 year, i.e., 1984's number sentenced is used to forecast persons received in 1985.

PROB1 – The number of persons sentenced to probation, lagged back 1 year.

PROB2 – The same as PROB1, but lagged back 2 years.

CRIM3 – The number of criminal cases (excluding transfers) filed in the U.S. district courts, lagged back 3 years.

YEAR – The statistical year ended June 30th of the year forecasted. For example, in forecasting the number of persons received in the year ended June 30, 1985, the number 1985 would be used for this variable. For the number received in the fiscal year ended September 30, 1985, one quarter later, the number 1985.25 is used. To forecast the calendar year ended December 31, 1985, using this equation, you would use YEAR=1985.50.

The equation for forecasting persons received (REC0, lagged back 0 years) is:

REC0 = -1,585,600 + 2.7876 IMPR21 + 1.2727 PROB1 - 0.84130 PROB2 + 0.25809 CRIM3 + 806.47 YEAR

The intercept of -1,585,600 and the coefficients of 2.7876, 1.2727, etc. in the regression equation are derived by the method of least squares. This gives the smallest difference between the estimates of persons received that can be derived from these variables and the actual historical data. If we are forecasting persons received in the "statistical year" ended June 30, 1984, then we use in the equation:

IMPR21 = 2,671, from statistical year 1983;
PROB1 = 14,097, from statistical year 1983;
PROB2 = 12,723, from statistical year 1982;
CRIM3 = 30,355, from statistical year 1981; and
YEAR = 1984.00, statistical year 1984.

Forecasting farther ahead than 1984 would require using estimates for some or all of the first four predictor variables. The 1984 estimate is calculated:

RECO = -1,585,600 + (2.7876 x 2671) + (1.2727 x 14,097) + (-0.84130 x 12,723) + (0.25809 x 30,355) + (806.47 x 1984.00)
= 36,954.

2. Persons Removed

The best predictor variables for forecasting the number of persons removed from supervision (excluding transfers) next year are the numbers under supervision this year and in previous years. The variables are:

UNDER 1,2,3 – The number under supervision 1, 2, or 3 years before the year being forecasted.

YEAR – Explained above.

The two forecasting models are:

REM0 = 297,290 + 0.45852 UNDER1 + 0.12949 UNDER3 - 151.65 YEAR

REM0 = 3,911.9 + 0.84201 UNDER2 - 0.37745 UNDER3

3. Persons Under Supervision

Variables which we've discussed above are also useful for forecasting the number of persons under supervision. These variables are:

REC1 – Persons Received, lagged 1 year.

PROB1 – Explained above.

IMPR21 – Number of persons sentenced to 13 through 35 months imprisonment, lagged back 1 year.

IMPR23 – Same variable, lagged 3 years.

IMPR23SQ – The variable IMPR23, with 3,500 subtracted from each year's number sentenced to prison, then squared.

CRIM3 – Explained above.

YEAR – Explained above.

The two forecasting models are:

UNDER0 = 5,987 + 1.8730 REC1 - 2.2886 IMPR23 + 0.0009250 IMPR23SQ

UNDER0 = -3,057,300 + 1554.3 YEAR + 1.0040 PROB1 + 0.47238 CRIM3 + 4.8439 IMPR21.

As mentioned earlier, a third forecast for persons under supervision at the end of the year can be created by subtracting the forecast of persons removed and adding the forecast of persons received to the previous year's number under supervision. Because there are two forecasts for persons removed, this does allow the possibility of creating two forecasts with this procedure.

Choosing from among these four forecasts for persons under supervision is, admittedly, a subjective process. Forecasting is as much art as science, and there is a place for educated guesswork and even "gut feelings." If all of the forecasts were equally reliable, one would use the average of the different forecasts as the final forecast. If some were clearly better than others, then you would give the better ones more weight in making the decision. However, if you had good reason to believe that all the forecasts were likely to be high (e.g., because of a policy change that the model couldn't take into account), then you would want to use the lowest of the choices.

These forecasting models have evolved over the last 4 years. The earliest models did not have the same variables. They gave very inaccurate estimates, but the refined models in the last 2 years have been much better. A large part of the job of forecasting is finding the right predictor variables, and this can take several years. One way to improve the process is to leave out of your calculations the most recent year for which you have data and see if the model accurately predicts that year.

The most recent forecasts are considered to be a little high by the Probation Division personnel who have reviewed them, and I believe that their assessments are correct. Undoubtedly, the models will be refined further in the years to come. If you use models with these same variables, you should consider the possibility of them giving projections on the high side when subjectively determining the final forecast.

Short-Term Forecasting

The forecasting models just discussed are used for projections of a few years into the future. Forecasting ahead one or two quarters, however, can be handled more easily and more accurately. Statistics such as persons received for and persons removed from supervision are totals for an entire year in the forecasts I do for the Federal Probation System's budget. Because these are annual totals instead of a count as of a certain day (like the number of persons under supervision at the end of the fiscal year), there is an easy way to make short-term forecasts. This method is to use the annual total every quarter as the variable which forecasted. In other words, for the September 1984 total, use the total from October 1983 through September 1984; for December 1984, use January through December 1984; etc. This has several advantages, the most important being that the use of annual totals eliminates all seasonal variation. Each quarter's annual total contains much of the data from the previous quarter's annual total, so it changes relatively little from one quarter to the next. When graphed, this is a smooth curve with gradual changes which is easy to predict one or two quarters ahead. The forecast is just a continuation of the trend seen when these annual totals are graphed. Graphing at least 2 or 3 years' worth of data is best.

[1] As with the accident example above, this predictor variable is useful for predicting the total number of persons received for supervision from all sources, not just parolees. Of course, in combination with variables that also predict probationers, the overall forecasting accuracy of the model improves greatly.

[2] A linear relationship between two variables X and Y is defined by Y = aX + b, where a and b are constant numbers. An example would be (TOTAL PERSONS RECEIVED) = 3 X (DEFENDANTS SENTENCED TO 2 YEARS OF PRISON) + 125. In other words, defendants times 3, plus 125 gives an estimate of persons received. This equation, when graphed, is a straight line, hence the name "linear relationship."

For this simple extension of the trend over time, the independent (i.e., predictor) variable in the regression model is the year. In converting a month and year into a single number to use as a predictor variable, June 1984 can be denoted by 1984.00 (or better yet, just 84.00), March 1984 would be 83.75, and September 1984 would be 84.25. If there is a straight-line trend over the last few quarters in the variable you are trying to forecast, then a linear regression over those quarters with the year as the independent variable will allow you to extrapolate that trend.

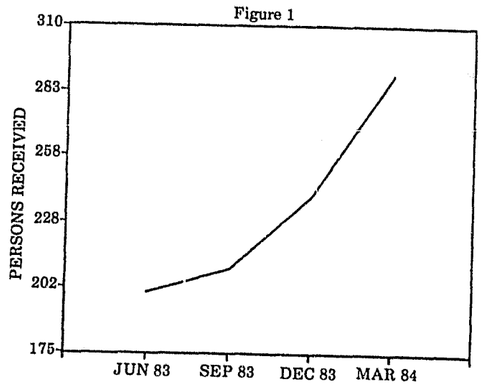
The situation is more complicated if the trend is a curved rather than a straight line. I've had the most success using *parabolic regressions* for extrapolating ahead a quarter or two. (If you can't visualize this curve, a parabola is the path followed when a ball is thrown or kicked. Think of "the long bomb" in football.) You compute a parabolic regression by using the year as one of the predictor variables and by using the year squared as the other. The mean of the years used (or a round number close to it) should be subtracted from each year's value before squaring it. An example at this point will help illustrate the concept. Suppose we are trying to fit a parabolic regression over four quarters to the number of persons received for supervision to forecast for the year ended June 1984.

The made-up data are:

Year Ended	Persons Received
June 1983	200
September 1983	210
December 1983	240
March 1984	290

The graph of this curved increase makes it obvious that a linear (straight-line) extrapolation is inappropriate:

Figure 1



The first predictor variable YEAR expressed numerically is: June 1983 = 83, September 1983 = 83.25, December 1983 = 83.5 and March 1984 = 83.75. The mean of these numbers is close to 83.5, so we'll use that to subtract from YEAR before squaring it:

YEAR	YEAR SQUARED	PERSONS RECEIVED
83	$(83-83.5)^2=(-0.5)^2=0.25$	200
83.25	$(83.25-83.5)^2=(-0.25)^2=0.0625$	210
83.5	$(83.5-83.5)^2=(0)^2=0$	240
83.75	$(83.75-83.5)^2=(0.25)^2=0.0625$	290

The next step is to compute a multiple regression on persons received with YEAR and YEAR SQUARED as the independent variables. Once the equation is calculated, substituting 84 for YEAR and $(84-83.5)^2=0.25$ for YEAR SQUARED will give an estimate for June 1984. Subtracting 83.5 from the YEAR before squaring it results in a line with a definite curve in it. The line goes from 0.25 down to 0.0625, down to 0 and then back up to 0.0625. Without subtracting the 83.5, the progression of 83^2, 83.25^2, 83.5^2, and 83.75^2 would be 6889, 6930.5625, 6972.25, and 7014.0625. This line is only slightly curved, and is only a slight improvement over the completely straight variable YEAR. It will not fit a curved variable like PERSONS RECEIVED very well.

General Forecasting Considerations

I want to discuss seven general considerations to keep in mind while doing any kind of forecasting. The following section will deal with considerations involving forecasting just probation statistics.

First, it is difficult to overemphasize the importance of graphing the data, both the variable to be predicted and the predictor variables. Graphing the data over a 20- or 25-year period can give you an idea of the general trend and the forces that affect your district's caseload. It can also give a general idea of what a reasonable forecast should be—or shouldn't be. A comparison of the variable to be predicted and potential predictor variables can tell you the best number of years to lag the predictor. For example, suppose you are forecasting persons received for supervision using criminal cases filed. If criminal cases filed historically reach their lowest point and then start increasing 2 years before persons received for supervision do, then it is likely that a 2-year lag for criminal cases filed is the best.

Second, it is important to understand that forecasting is a trial and error process. You have to try different variables in the regression model which might be useful predictors, and some variables that don't work well by themselves might be very good

in combination with others. Graphs might indicate that a 2-year lag for a variable gives the best predictor, but in actually trying it with other predictor variables also in the regression equation, a 3-year lag might be preferable. If your computer and its software are capable of doing this, put every predictor variable into the equation to start and then eliminate those which make no contribution.[3] This is called *backward elimination* and is better than adding variables one at a time (forward selection). Having the capability to re-enter a variable which has been removed by backward elimination is the best possible situation.

Third, for a multiple regression model to give reliable forecasts 2 or 3 years into the future, it is best to have at least 20-25 years of historical data. This is the optimum situation, of course; in many situations the data are just not available. Another problem that can occur is that some unknown change in the data collection or circumstances of probation took place which causes the model to fit part of the data poorly. In these instances there is no choice but to use fewer than 20-25 years of data.

Fourth, the coefficient of determination R^2 is produced by every computer package and is commonly known as a measure of how well a regression model fits a particular set of data. However, there is one other measure which is actually more useful. The *standard error of the estimate* can be thought of as the average difference between the model's estimate and the actual historical data. It is not exactly that quantity, but "the average difference between the estimates and the data" makes more sense intuitively than the correct "square root of the mean square error." This statistic is printed by most computer packages. If not, it can be found by taking the square root of the residual mean square (also known as mean square error) in the analysis of variance table. This statistic is more useful than R^2 when R^2 gets up to about 0.98 or 0.99. For example, in forecasting persons received, you might have a model with two predictor variables, an R^2 of 0.991, and a standard error of 500 persons received. Adding one more predictor variable might substantially improve the standard error to 300 persons received, but only increase the R^2 to 0.994. The improvement was substantial, but you couldn't tell that by looking at only the R^2.

[3] A variable does not "make a contribution" if it is multiplied by a coefficient that is very close to zero when it is part of the regression model. Your statistics package should include partial F or t tests which measure the significance of that variable's coefficient. This allows you to test the hypothesis that the variable's coefficient is significantly different from zero.

The fifth consideration is how far back to lag the predictor variables. Suppose you are forecasting persons received for supervision from parole with one predictor variable, defendants sentenced to prison lagged back 1 year. If you are only forecasting ahead 1 year, the 1984 number of defendants sentenced can be used to forecast persons received in 1985. However, if it is necessary to forecast ahead 2 years, the predictor variable itself has to be forecasted ahead 1 year before you can forecast persons received in 1986. There are times when a variable such as "defendants sentenced to prison" can be a good predictor when lagged 2 years but a better predictor when it is lagged only 1 year. The tradeoff is whether to use a decent predictor and not have to forecast it or to use a better predictor and decrease its worth by using a forecasted value to predict with. This has to be a subjective decision based on the differences in the standard errors using the two lags and your confidence in your ability to accurately forecast the predictor variable. Care also has to be taken not to lag variables too far. When this occurs, a graph of the actual and the predicted data values may show that when persons received for supervision changes direction (peaks or bottoms out), the predicted values change direction 1 year too late.

The sixth general consideration of forecasting is the problem of *serial correlation.* A "residual," also known as an "error," is the actual historical data value minus the value estimated by the regression model. If there are 25 data points in the historical data, then there are 25 residuals, about half of which are positive and the rest negative. If there is a correlation between each residual and the residual from the time period before that, that is serial correlation. Serial correlation can be positive or negative. If positive, then a positive residual is more likely to be followed by a positive one, a negative more likely to be followed by a negative. Negative serial correlation is where if one residual is positive, the next residual is likely to be negative, and vice-versa. The existence of serial correlation indicates that the model may not be a good estimator of the relationship between the predictor variables and the variable being forecasted. The standard error may be deceptively low. A consequence of positive serial correlation is that if the estimate for the last data value is too high or low (it has to be one or the other), then the first forecasted value is more likely to be too high or low, respectively. The ideal situation is that the forecasted values are as likely to be too high as they are to be too low.

It is possible to test for serial correlation using the

Durbin-Watson statistic, and a discussion of that can be found in Wonnacott and Wonnacott (1979). A partial solution to the problem of serial correlation is to change the variables. Instead of computing the regression with the original variables, compute it with the *first difference* of the predictor variables and the variable to be forecasted. The first difference of a variable is just each original value minus the previous year's value; i.e., the difference from the previous year. When forecasted, the predictions are of how much the variable will increase or decrease in the year being forecasted. Using this procedure decreases the number of data points by one because there is usually nothing to subtract from the first year's value. If it does not solve the problem of serial correlation, more sophisticated methods need to be used (Wonnacott and Wonnacott, 1979).

A related matter regarding the residuals is that graphs of them should be examined to find possible faults with the model. For each of the graphs, the residuals should be plotted on the Y-axis and each of the predictor variables on the X-axis. A straight band of residuals for all of the predictor variables is a good sign. The use of the linear regression equation to estimate a nonlinear relationship is one common problem that can be detected using these residual plots. This is shown in Figure 2; Figure 3 is an example of one graph from a model which has no problems:

Figure 2
RESIDUAL PLOT
EXAMPLE OF NONLINEAR RELATIONSHIP

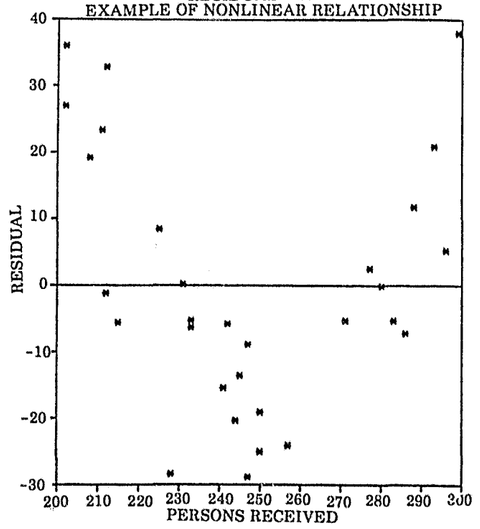
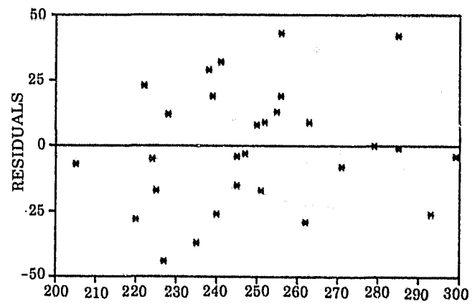


Figure 3
RESIDUAL PLOT
HOW RESIDUALS SHOULD LOOK

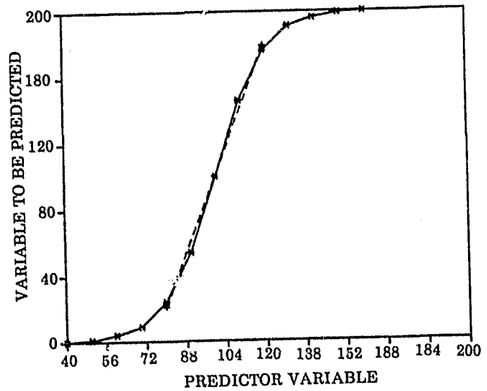


Evaluating the residual plots is an important part of determining the quality of one's forecasting model. If you want more details, these can be found in Draper and Smith, Chapter 3.

The final idea to consider with any type of forecasting is that you have to be willing to discard forecasts which just don't make sense. It's important to understand why a forecast can be completely wrong. A regression model estimates the relationship between one or more predictor variables and the variable which you are trying to forecast. It estimates this relationship over the particular time period for which you have data. The relationship may change after the present to something different in the future years you are trying to forecast. A more common occurrence is that the relationship is more complex than the regression model accounts for. This is best illustrated in the accompanying diagram. The actual relationship between the two variables may be curvilinear, but is well approximated by a straight line in the years for which historical data are available. When you attempt to forecast into the future, it might give you ridiculous predictions.

While you should be willing to discard forecasts which defy common sense, this should be done cautiously. An "expert" or supervisor who is reviewing the forecast (or even you yourself) may have a preconceived idea about the future which is just plain wrong. I once was told regarding a forecast, "Filings will never go *that* high," only to find a year later that the forecast was much too low. Depending on how it is perceived, a forecast of modest 5 percent increases 3 years in a row may look like an incredibly large jump at first glance. Also, forecasts should not be lightly discarded as unrealistic because there have been instances of "surprise" changes of direction in numbers which individuals did not foresee but which were discovered by regression models. Equations, for all their faults and limitations, at least do not have preconceived notions of what the future will be.

Figure 4
ACTUAL AND ESTIMATED RELATIONSHIP
BETWEEN TWO VARIABLES



SOLID LINE - ACTUAL RELATIONSHIP
DASHED LINE - ESTIMATED RELATIONSHIP

Probation Forecasting Considerations

Having mentioned seven aspects of forecasting which apply no matter what is being forecasted, it is now appropriate to discuss five matters which relate specifically to forecasting probation statistics.

First, you should get some idea of historical and anticipated criminal defendant activity. How many criminal defendants have been (1) brought to the courts, and (2) convicted? What does the law enforcement agency's budget 2 years hence indicate regarding the number of defendants who will be brought to the court? Are there any anticipated program changes which will affect either the number of defendants or the proportion receiving probation? Are new statutes or legislative initiatives expected? Having even a rough idea of the law enforcement agency's plans can give you an intuitive idea of what the final forecast should be like.

The second consideration in forecasting probation data is the fact that the number of persons under supervision may contain seasonal variation. Unlike the number of persons received for or removed from supervision, persons under supervision is not a total added up over a 12-month period. It is a count as of a certain day (the end of the quarter) and, as far as I can tell, seems to be lower on the average on September 30th and December 31st than on March 31st or June 30th. Looking at monthly data might reveal even more distinct patterns. There may be no seasonal variation in the case of your individual district, or different days may be the lowest ones.

The third matter to discuss that relates specifically to probation forecasting is that these multiple regression models do not construct a complete picture of the flow of people in the probation system. This is frequently people's expectation when I discuss probation forecasting with them—they assume that every source for people and every reason for removal from the system is carefully documented. It would be possible to forecast this way, but very cumbersome and expensive. Multiple regression takes shortcuts around that procedure by taking advantage of correlations between variables. For example, you could make a halfway decent forecast of persons received using only persons sentenced to probation, which ignores persons received from prisons. This is because regression uses the correlation between the two variables to construct the model; it doesn't matter that these are other sources for individuals who enter the probation system. If the number of people who enter from prisons is closely correlated with the number sentenced to probation, then adding the number from prisons to the regression model won't improve the model significantly if the number sentenced to probation is already part of the model.

The fourth consideration which is relevant to probation forecasts in particular is the issue of dividing an overall forecast into parts—how many of the persons under supervision are probationers, parolees, mandatory releasees, etc.? In determining this, the choice is between making one overall forecast and parcelling it among the different categories or forecasting each category separately and adding them all together. Except possibly in the situation where an accurate forecast of each category is more important than that of the overall total, an overall forecast broken into parts is preferable. The other procedure, while it seems good intuitively, increases the standard error of the overall projection, making it less reliable. Dividing the forecast into parts can be done by using the percentage of each of the categories from the most recent time period, or by forecasting the percentages. Forecasting the percen-

tages frequently can be done with just a linear extrapolation (using the year as the predictor variable), and then the forecasts will probably have to be fiddled with to make them add up to exactly 100 percent.

The last matter which relates specifically to probation statistics forecasting is a comment about consulting with experts. We discussed earlier that you should be willing to completely discard forecasts which just don't make sense. If you are not completely familiar with the probation system, you should discuss the forecast with those who are. I always consult with the Administrative Office's Probation Division before releasing my forecast, and they are very willing to discuss them with me. If you are a probation officer who is forecasting his or her district's caseload, you probably don't need outside advice on whether a forecast is reasonable, but you would want to discuss your assumptions and results with your colleagues. A fresh perspective and the opportunity to have your ideas critiqued can be very helpful. If you aren't that familiar with the situation, then you should get assistance on the crucial question of whether the prediction defies common sense.

Getting Help: Textbooks and Consultants

A very readable introduction to regression and correlation can be found in John E. Freund's *Modern Elementary Statistics,* 6th edition, 1983, Chapters 14 and 15. A good source for formulas and methods of computing linear and parabolic regressions is Murray R. Spiegel's *Statistics,* part of the "Schaum's Outline Series." This book features worked-out examples of regression computations, and Chapter 13 is of particular interest. You may also find Chapters 14 through 16 useful. Be careful not to confuse this with *Probability and Statistics* by the same author and publisher. *Statistics* has a blue cover.

More advanced textbooks which are also clearly written include *Applied Regression Analysis* by Norman Draper and Harry Smith. It is considered one of the classic textbooks on regression. Another text which is extremely good is *Econometrics,* by Ronald J. and Thomas H. Wonnacott. Its very clear style makes accessible many of the more difficult aspects of regression analysis.

Finally, you should not ignore the possibility of consulting and computer assistance from local colleges or universities. You may be able to get help from professors, graduate students, and even undergraduates in statistics, mathematics, economics, business, psychology or sociology departments. Sources of free assistance include student internships, programs to give statistics students an opportunity to have consulting experience, and professors who would exchange help for the right to publish the results. They would almost certainly have available for their use computers with statistical packages.

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The Armed Urban Bank Robber: A Profile

BY JAMES F. HARAN, PH.D. AND JOHN M. MARTIN, PH.D.*

BANK ROBBERY always receives media attention. Bank robbers frequently make the Federal Bureau of Investigation's most wanted list of criminals. Judges give bank robbers long sentences, and parole boards are reluctant to release these inmates who have been classified as violent criminals. The public in turn pictures bank robbers as carefully planning their "jobs" like the famous Willie Sutton; making their getaways heavily armed and in a blaze of gunfire, living up to the motion picture images of Dillinger, Ma Barker, Machine Gun Kelly and other infamous bank thieves of the thirties.

A study by the authors of 500 convicted armed bank robbers strips away much of this cinematic glamour from the bank robber and reveals a very different type of criminal personality compared to the usual stereotype. The study used detailed life history data and court and reported crime records to examine the careers of 500 convicted bank robbers predominantly from the highly urbanized area of New York City. The 500 robbers studied were all convicted armed bank robbers who appeared before the United States District Court in Brooklyn, New York between 1964 and 1976. These men were convicted of committing 281 separate bank robberies. Many were also involved in additional bank robberies with which they were not charged. The data, extending over a 12-year period (1964 to 1976), allowed an in-depth look at this particular form of violent crime and the people who engaged in this type of armed theft.

The Crime of Bank Robbery

Although bank robbery constitutes a relatively small portion (less than 2 percent) of robbery statistics, it is the fastest-growing type of robbery in the country. This growth rate gives little indication of halting. Bank robberies in the United States rose from 1,730 in 1967 to 6,597 in 1982, down slightly from the previous year 1981.[1] Analysis indicated that this crime was concentrated primarily in large urban areas.

Among the many categories of recorded crime, bank robbery is unique in several respects. First, bank robbery is perhaps the most fully reported of any crime known to the police. This is due to the regulations of the Federal Deposit Insurance Corporation, which insures over 95 percent of all banks. The FDIC regulations require the reporting of all bank losses by theft or burglary. This insures the reporting of bank robberies. Secondly, according to the FBI, over 80 percent of the bank robbers are identified and arrested. This is an exceptionally high rate of clearance by arrest in contrast to other types of crime and other types of robbery in particular.[2] Thirdly, the conviction rate of those arrested for this crime and prosecuted in the Federal courts is exceptionally high, averaging 88.8 percent for the 12-month period ending in June 1982.[3] Finally, Federal court practice requires that defendants, prior to sentencing, be uniformly subjected to an extensive social and criminal background investigation. These presentence reports are prepared by the trained investigative staffs of the probation departments attached to each United States District Court. This practice collects and summarizes the vast amount of data these offenders generate in their passage through the various components of the criminal justice system. The gathering of this data from law enforcement, courts, probation, prison, and parole agency records makes bank robbers, as a class of offenders, identifiable and amenable to an in-depth analysis.

Who Are the Bank Robbers?

Analysis reveals that the perpetrators of the violent crime of armed bank robbery were not a homogenous group. Further, as a group, their composition in many respects had changed substantially over the 12-year span of the study. The first variable examined revealed no surprise. Ninety-six percent of the robbers were male. Of the 18 convicted female bank robbers, only two assumed a principal role in the crime and only one was known to be armed. The others drove getaway cars or provided other ancillary services. Ninety-six percent were native-born Americans, and 65 percent were born in New York State. Within the city itself the

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[1] *Uniform Crime Reports, 1982,* p. 155.

[2] *Uniform Crime Reports, 1982,* p. 18: only "25 percent of robbery offenses reported to law enforcement were cleared during 1982."

[3] *Federal Offenders in United States District Courts, 1982,* Administrative Office of the United States Courts, Washington, D.C., 1983, p. H-38, Table H-19.

END