

The Effect of Pre-sentence Reports on Sentencing Probations

To: Probation Department Director

From: Yehzee Ryoo

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Executive Summary

The issue of whether to continue or stop having pre-sentence reports on defendants who have prior felonies has been raised by the members of the judicial system. Some of the members believe that subjective assessments made by the Probation Department are exerting too much influence on the ruling from the trial, while others feel that they make no significant differences. If the latter is true, assigning the department staff's efforts and responsibilities to continue writing reports seems pointless. To answer this question, I conducted a statistical model and found out that pre-sentence reports do make difference in what kind of sentence defendants get. Especially for the accused who has one to three previous records of felony convictions, having a pre-sentence report recommending getting probation increased the likelihood for the defendant to be sentenced to probation, rather than to prison time. Thus, I highly recommend you remind the staff of the Probation Department of the importance of their duties when writing a pre-sentence report. They are significantly affecting the judges' decisions in the trial. You should also be aware that if your department stops having the pre-sentence report system, the incarceration rate in the Gotham City is likely to increase.

Statistical Results

To estimate whether pre-sentence reports affect the decisions of the juries in sentencing, I conducted a statistical (logistic regression) model based on the previously collected data on 280 burglary cases. According to the regression result, only the 'Report' variable among four factors that may affect the result of a sentence involving probation – the number of prior felony

convictions, the dollar value of the stolen property, whether or not the burglary occurred at night, and whether or not the pre-sentence report recommended probation – shows the positive association with the outcome variable – the defendant receiving a sentence of probation, rather than prison time. This is shown in the first column of Table 1, ‘Report’ factor showing odds ratio bigger than 1. In other words, having a pre-sentence report recommending probation increases the likelihood of a defendant being sentenced to probation by approximately 3 times compared to having a pre-sentence report recommending a prison term. The other three variables seem to have negative associations with the outcome (odds ratio less than 1), rather decreasing the likelihood of the defendant getting sentenced to probation. Figure 1 shows the marginal effects of each factor on the Probation-sentencing.

Figure 1. Marginal Effects on Probation

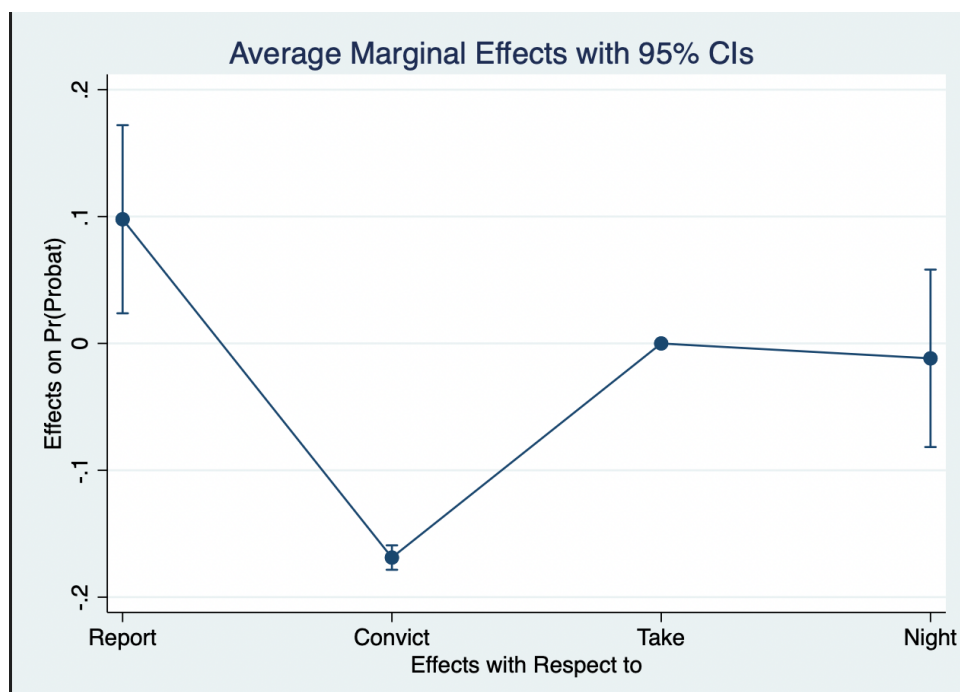


Table 1. Logistic Regression Result

<pre>. logistic \$ylist \$xlist</pre>						
Logistic regression			Number of obs		=	280
			LR chi2(4)		=	225.09
			Prob > chi2		=	0.0000
Log likelihood = -79.215677			Pseudo R2		=	0.5869
Probat	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
Report	3.066582	1.387883	2.48	0.013	1.263035	7.445502
Convict	.1447592	.0339736	-8.24	0.000	.0913854	.2293058
Take	.9998997	.0000692	-1.45	0.148	.999764	1.000035
Night	.8740599	.3571401	-0.33	0.742	.3924109	1.94689
_cons	43.66805	27.62912	5.97	0.000	12.63578	150.9127
Note: _cons estimates baseline odds.						

Moreover, I estimated the predicted probabilities of being sentenced to probation rather than to prison time depending on various combinations of independent factors. Figure 2 shows the scatter plot of two variables – Convict and Report – and the predicted probabilities of Probation. By fixing the values of Night and Take variables, I examined more detailed effects of ‘Convict’ and ‘Report’ factors on judges’ ruling. Table 2 shows the following result. The result signifies that when the ‘Convict’ value reflecting the number of prior felony convictions was 0 or 4 or 5, having a pre-sentence report does not make a significant difference in judgment. Yet, when the defendant has 1 or 2 or 3 prior felony convictions, having a pre-sentence report recommending probation slightly increases the probability of being sentenced to probation rather than being sentenced to jail.

Figure 2. Probabilities of Getting Probation and Number of Prior Felony Convictions

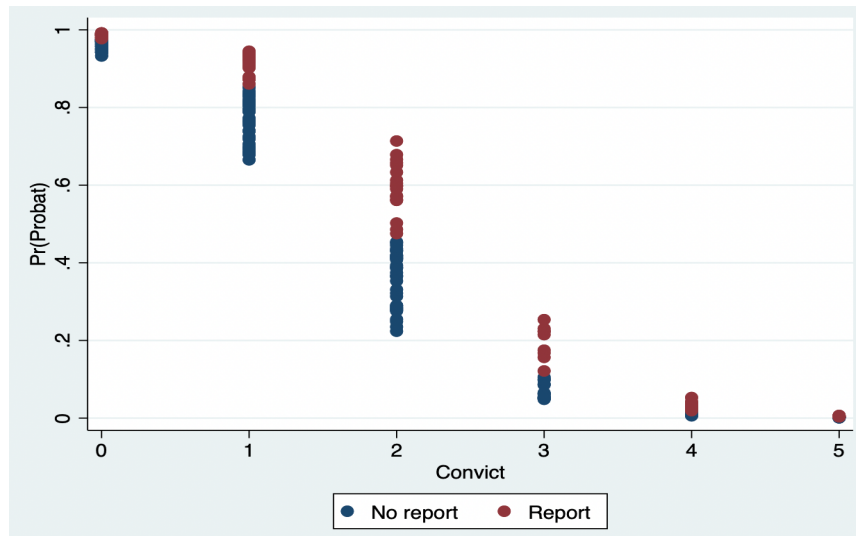


Table 2. Predicted Probabilities from the Logistic Regression

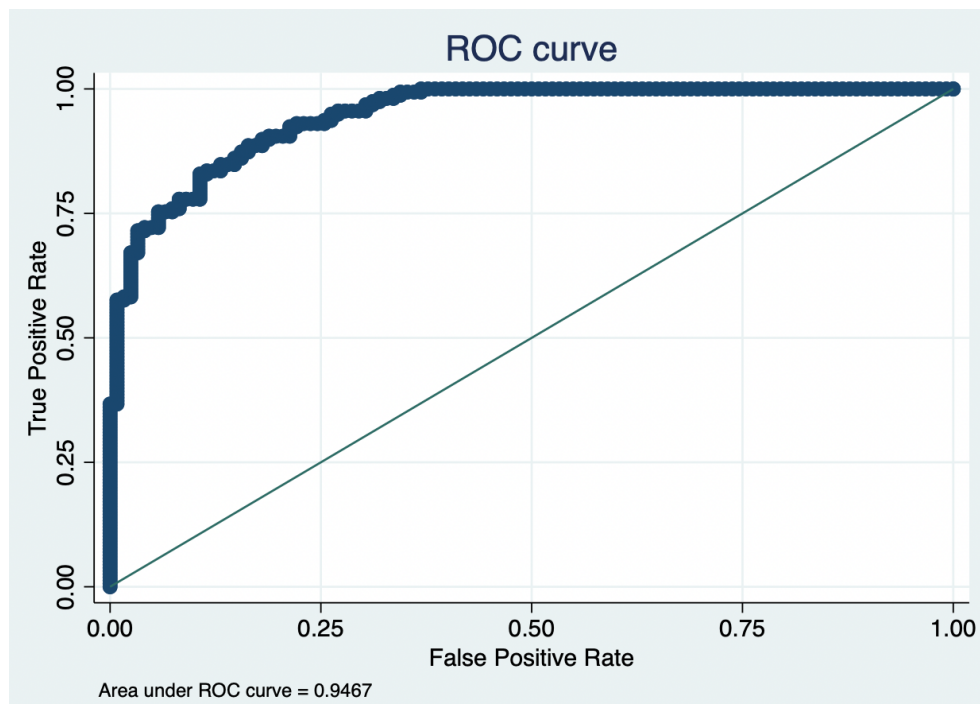
Convictions	No Report	Report	Report – No Report
0	1.0	1.0	0
1	0.8	0.9	0.1
2	0.4	0.6	0.2
3	0.1	0.2	0.1
4	0.0	0.0	0
5	0.0	0.0	0

Lastly, to evaluate if the model I used is good enough to predict the outcome, Probation, I conducted a sensitivity analysis. Sensitivity analysis shows the true positive rate and true negative rate of the prediction made through the logistic model. According to Table 3, the rate of correctly classified cases is 86.43, which seems fairly high. Moreover, the ROC curve in Figure 3 shows another result of evaluating a fit of the model. The area under this curve is about 0.95, showing that the model is quite accurate.

Table 3. Sensitivity Analysis Results

Logistic model for Probat			
Classified	True		Total
	D	~D	
+	140	20	160
-	18	102	120
Total	158	122	280
Classified + if predicted $\text{Pr}(D) \geq .5$			
True D defined as Probat $\neq 0$			
Sensitivity	$\text{Pr}(+ D)$	88.61%	
Specificity	$\text{Pr}(- \sim D)$	83.61%	
Positive predictive value	$\text{Pr}(D +)$	87.50%	
Negative predictive value	$\text{Pr}(\sim D -)$	85.00%	
False + rate for true ~D	$\text{Pr}(+ \sim D)$	16.39%	
False - rate for true D	$\text{Pr}(- D)$	11.39%	
False + rate for classified +	$\text{Pr}(\sim D +)$	12.50%	
False - rate for classified -	$\text{Pr}(D -)$	15.00%	
Correctly classified		86.43%	

Figure 3. ROC curve of the regression model



Appendix

```
net install PS813_EX4, from(https://weimer.polisci.wisc.edu)
```

```
PS813_EX4 0102
```

```
*logit Regression
```

```
logit Probat Report Convict Take Night
```

```
global xlist Report Convict Take Night
```

```
global ylist Probat
```

```
summarize $ylist $xlist
```

```
*coefficients
```

```
logit $ylist $xlist
```

```
*odds ratio
```

```
logistic $ylist $xlist
```

```
*Coefficient and Covariances from the Regression
```

```
matrix define b = e(b)
```

```
matrix define V = e(V)
```

```
matrix list b
```

```
matrix list V
```

```
*Calculate the logit bounds
```

```
**capture program drop = preventing premanent changes in live editing
```

```
capture program drop Logit_bounds
```

```
program define Logit_bounds
```

```
drop _all
```

```
drawnorm c_report c_convict c_take c_night c_cons, means(b) cov(V) cstorage(full)
n(1000)
```

```
generate z=`1'*c_report+`2'*c_convict+`3'*c_take+`4'*c_night+c_cons
```

```
generate p = 1/(1+exp(-z))
```

```
sum p, d
```

```
end
```

```
**** Logit_bounds Report Convict Take Night ****
```

```
* mean_Take = 5120.95
```

```
* mean_Convict = 1.746429
```

```
*when Report is 0 and Night is 0 and others are mean values
```

```
Logit_bounds 0 1.746429 5120.95 0
```

```
*when Report is 1 and others are the same with the previous setting
```

```
Logit_bounds 1 1.746429 5120.95 0
```

```
*Convict 0 to 5
```

```
Logit_bounds 0 0 5120.95 0
```

```
Logit_bounds 0 1 5120.95 0
```

```
Logit_bounds 0 2 5120.95 0
```

```
Logit_bounds 0 3 5120.95 0
```

```
Logit_bounds 0 4 5120.95 0
```

```
Logit_bounds 0 5 5120.95 0
```

```
Logit_bounds 1 0 5120.95 0
```

```
Logit_bounds 1 1 5120.95 0
```

```
Logit_bounds 1 2 5120.95 0
```

```
Logit_bounds 1 3 5120.95 0
```

```
Logit_bounds 1 4 5120.95 0
```

```
Logit_bounds 1 5 5120.95 0
```

```

graph twoway (scatter yhat Convict if Report==0) (scatter yhat Convict if Report==1),
///
legend(label(1 No report) label(2 Report))

*sensitivity test
net install PS813_EX4, from(https://weimer.polisci.wisc.edu)
PS813_EX4 0102

logit Probat Report Convict Take Night
predict yhat
scatter yhat Report
scatter yhat Convict

margins, dydx(*)
marginsplot

lstat
*(lstat = same with the 'estat classification' function)
** what I am reporting = 86.43% (correctly classified);

lroc, title("ROC curve") xtitle(False Positive Rate) ytitle(True Positive Rate)

```