Receiver Operating Characteristic

	Predicted Y=0	*Predicted Y=1*	*Total*
Actual Y=0	Correct Decision True Negative (TN)	Type I Error False Positive (FP)	N
Actual Y=1	Type II Error False Negative (FN)	Correct Decision True Positive (TP)	P
Total			N+P

Sensitivity and Specificity

$$Accuracy\ or\ Overall\ \ Counted\ \ R^2 = \frac{TP + TN}{P + N}$$

$$Sensitivity = \frac{TP}{P}$$

$$Specificity = \frac{TN}{N}$$

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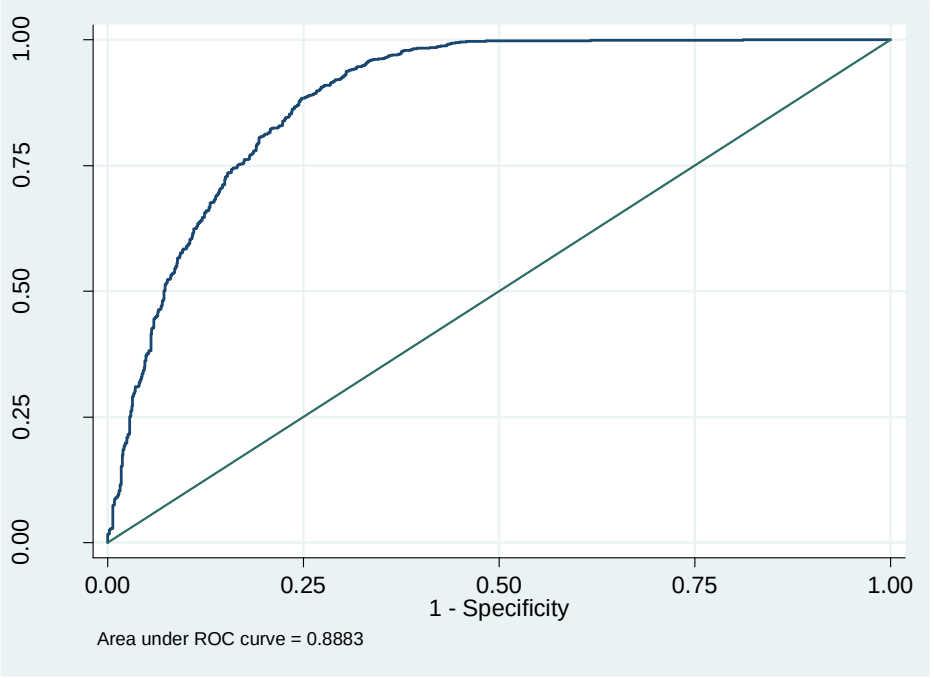
Receiver Operating Characteristic

A receiver operating characteristic (ROC), or simply ROC curve, is a graphical plot of the sensitivity vs. (1-specificity) for a binary classifier system as its discrimination threshold is varied.



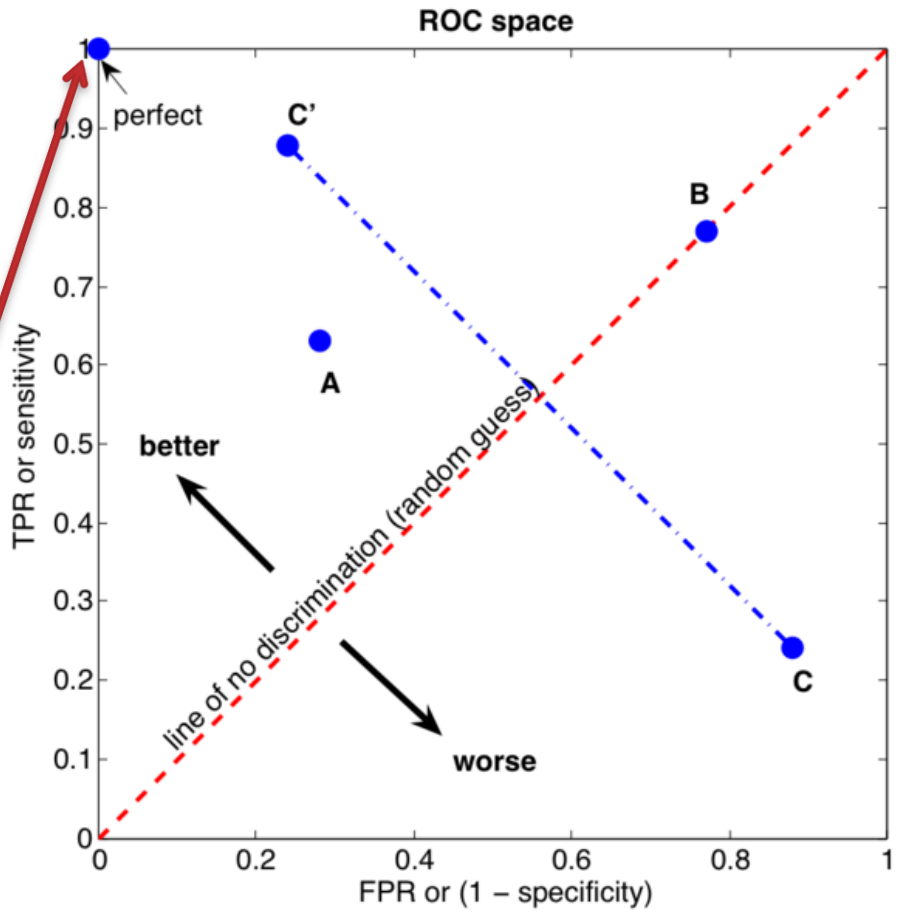
Receiver Operating Characteristic

The ROC can also be represented equivalently by plotting the fraction of true positives (TPR = true positive rate) vs. the fraction of false positives (FPR = false positive rate).

ROC (Relative Operating Characteristic) curve is a comparison of two operating characteristics (TPR & FPR) as the criterion changes.

ROC Curve

The best possible prediction method would yield a point in the upper left corner or coordinate (0,1) of the ROC space, representing 100% sensitivity (no false negatives) and 100% specificity (no false positives). The (0,1) point is also called a perfect classification.



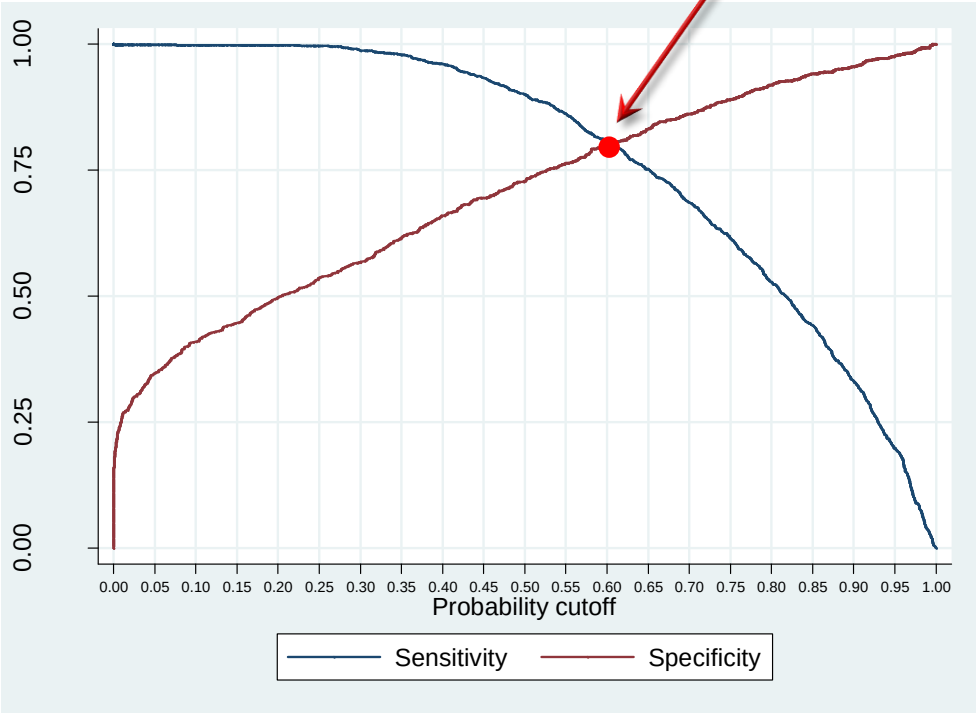
ROC Curve

A completely random guess would give a point along a diagonal line (the so-called line of no-discrimination) from the left bottom to the top right corners. An intuitive example of random guessing is a decision by flipping coins (head or tail).

ROC can be used in helping determine the cutoff point (threshold value) in order to balance between type I and type II error in predicting $Y=0$ and $Y=1$.

Balancing Type I and Type II Error ROC Determining Cutoff Point

ROC can be used in helping determine the cutoff point (threshold value) in order to balance between type I and type II error in predicting $Y=0$ and $Y=1$.



Evaluation Criteria

1. Sign and meaning of the Coefficients.
   - Whether the estimated results are according to the theory.
   - Meaning – Marginal Effects at …
2. Overall Test – LR-Chi-squares-test.
   - Whether all explanatory variables can be used in explaining the dependent variable.
3. GOF and Forecasting Error Index.
   - Pseudo R^2 - How well does the estimated results contribute to the likelihood of the model? – Making comparison
   - Counted R^2 and ROC

Evaluation Criteria

4. Individual Test – z-test.

- Whether each explanatory variables can explain the dependent variable.
- z-test – MLE assume Asymptotic Normal.