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\* Homework 5

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\* Instructions:

\* To create this document, first copy and paste the full text here into a .Do document (a STATA Do-File).

\* Below each question, write the code you used to answer the question

\* Next, write your actual answer to the question by commenting out your writing (by starting the line with a \*)

\* Next, copy and paste the entire document (my writing and yours) into a Word document. This will allow me to see your code on Canvas without downloading every homework.

\* The goal is that I should be able to copy and paste your entire text into a .Do File and run the code without any errors.

\* Finally, submit file as Homework 5 on Canvas

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\* Topic 1: Logistic Regressions

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\*1. Import the LendingData excel file into Stata

\* The dataset includes three variables:

\* home\_ownership: Binary variable where a 1 denotes home ownership, 0 is a renter

\* income: income of borrower

\* dti: Debt to income Ratio

\* fico: Credit score

\* loan\_status: Binary variable where a 1 denotes repayment, 0 is default

\* TestData: Binary variable where a 1 denotes Test Data, 0 denotes Training Data

clear

import excel "/Users/henryvelasquez/Documents/MBA/MBA S3/2nd 7/Machine Learning in Finance K579/HW5/LendingClubData.xlsx", sheet("Sheet1") firstrow

\*2. run a logistic regression on the training data with Loan Status as the y-variable and credit score as the x-variable for the Training Data

logit loan\_status fico if TestData==0

\* 3. Predict Loan Status from the regression above

predict loanStatusPrediction

predict loanStatusResiduals, residuals

summarize loanStatusResiduals, detail

\*4. Create a scatter plot with loan status as the y-variable and credit score as the x-variable. Plot the predicted loan status on top

twoway (scatter loanStatusPrediction fico) (scatter loan\_status fico,sort)

\*5. Estimate four alternative logistic models using the training data:

\* Model 1: Loan Status is predicted by credit score

\* Model 2: Loan Status is predicted by credit score and Debt-to-Income

\* Model 3: Loan Status is predicted by credit score, Debt-to-Income, and Income

\* Model 4: Loan Status is predicted by credit score, Debt-to-Income, Income, and Home Ownership

\* For each model estimate the predicted loan\_status and the residual

\*Model 2

logit loan\_status fico dti if TestData==0

predict loanStatusPrediction\_dti

predict loanStatus\_dti\_residuals,residuals

summarize loanStatus\_dti\_residuals, detail

\*Model 3

logit loan\_status fico dti income if TestData==0

predict loanStatusPrediction\_dti\_income

predict loanStatus\_dti\_income\_residuals, residuals

summarize loanStatus\_dti\_income\_residuals, detail

\*Model 4

logit loan\_status fico dti income home\_ownership if TestData==0

predict loanStatusModel4

predict loanStatusModel4residuals, residuals

summarize loanStatusModel4residuals, detail

\*6. Estimate model 4 again using the training data, but with a linear regression

\*Estmate the prediction and residual

reg loan\_status fico dti income home\_ownership if TestData==0

predict linear\_model4\_prediction

predict linear\_model4\_residuals, residuals

summarize linear\_model4\_residuals, detail

\*7. Compare the MSE of the five models above using the test data

summarize l\*residuals, detail

summarize linear\_model4\_residuals

\*8. z-score all four of the x-variables

foreach var in home\_ownership income dti fico {

egen mean =mean(`var')

egen sd = sd(`var')

gen zscore\_`var' = (`var'-mean)/sd

drop mean sd

}

\*9. Use LASSO to test for the best model using the training data

\* Hint: the new command is lasso logit

lasso logit loan\_status zscore\* if TestData==0

\*10. Estimate the coefficients from the lasso estimation using the command:

\*lassocoef, display(coef, postselection)

\* How many coefficients are there. Why?

lassocoef, display(coef, postselection)

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\* Topic 2: Decision Criterion and ROC Curves

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\*11. Keep only the Test Data

keep if TestData == 1

\*12. You will need to estimate the True Positive Rate and False Positive Rate not just once, but at many z thresholds.

\* For practice, we will estimate these rates 100 times for every 0.01 increase in the Z-treshold from 0 to 1

\*The first step is to create two new variables

\* TruePositiveRate =.

\*FalsePositiveRate = .

gen TruePositiveRate=0

gen FalsePositiveRate=0

\*13. Next, we need to create a forvalues loop for each of the 100 estimates

\*Use the code

\*14. Step 1 of the forvalue loop: Create a new variable

\* dummy = 100\*`i'

\*14. Step 2 of the forvalues loop: estimate which loans were paid based on the Z-thresholds for each observation

\*15. Step 3 of the loop: Estimate TP, TN, FP, and FN for each observations

\*16. Step 4 of the loop: Estimate the mean TP, TN, FP, and FN

\* Create a variable with the mean of each measure

\*17. Step 5 of the loop: replace the True Positive Rate and False Positive Rate variables if \_n== dummy

\*18. Step 6 of the loop: drop all new variable except the True Positive Rate and False Positive Rate

forvalues i = 0(.01)1 {

gen dummy = 100\* `i'

gen predict\_repaid = 0

replace predict\_repaid = 1 if linear\_model4\_prediction > `i'

gen TP = 0

replace TP=1 if predict\_repaid==1 & loan\_status==1

gen TN = 0

replace TN =1 if predict\_repaid==0 & loan\_status==0

gen FP = 0

replace FP =1 if predict\_repaid==1 & loan\_status ==0

gen FN = 0

replace FN=1 if predict\_repaid==0 & loan\_status==1

sum TP FN FP FN

egen meanTP = mean(TP)

egen meanTN = mean(TN)

egen meanFP = mean(FP)

egen meanFN = mean(FN)

replace TruePositiveRate = meanTP/(meanTP+meanFN) if \_n==dummy

replace FalsePositiveRate = meanFP/(meanTN+meanFP) if \_n==dummy

capture drop predict\_repaid TP TN FP FN dummy mean\*

}

\*19. Keep only the first 100 observations

drop if \_n < 01

\* Create a scatter plot with the True Positive Rate as the y-variable and False Positive Rate as the x-variable

twoway scatter TruePositiveRate FalsePositiveRate (connect )

\*20. Add to the plot above a new line across the 45 degree line

gen x = 0

gen y= 0

forvalues i = 0(.01)1 {

gen dummy = 100 \* `i'

replace x = 1 - `i' if \_n==dummy

replace y = 1 - `i' if \_n==dummy

drop dummy

}

twoway(scatter TruePositiveRate FalsePositiveRate) (lfit y x)