Spring 2022

AI for Finance

(Due 10 April, 2022)

Project #3 (Probit models to forecast binary outcomes such as recessions)

Scenario: You are a portfolio manager. Hence, you want to rebalance your portfolio from high beta stocks to low beta stocks before recessions. As a result, you may want to find a model that has some predictability of recessions.

1) **Try to replicate the Estrella and Hardouvelis (1991) (http://hardouvelis.gr/wp-content/uploads/2017/12/JF_June_1991_462_555-76_HQ-1.pdf) results.**

First, you construct the dataset and do initial checks such as the correlation between variables and the stationarity analysis of variables.

Here are the data you need 1) The Federal Funds Rate; 2) the Treasury TERM spread; 3) U.S. Stock Market Returns; 4) U.S. GDP growth; 4) NBER Recessions data. The relevant data are available @ BEA/NBER – some data you already have/you know the source. Since GDP data is quarterly, we need to do the analysis quarterly. Convert monthly data to quarterly by taking an average.

The analysis is for the 1955-present sample.

You need to run a Probit model as explained in class.

The dependent variable is the NBER recessions binary variable. Since we want to forecast recessions, use lags (up to 12 quarters) of the explanatory variables. Report the results in a tabular form. We have at least 24 models:

I. **Only TERM as explanatory variable – 12 models here for 12 quarters lags, one lag at a time.**
II. **In each quarter, you add other 3 explanatory variables – 12 models here for 12 quarters, one lag at a time.**

1. **Tweak the models in #2 above based on statistical significance of the coefficients.**

Please read the overview of the paper to make a report on the project.

a) **Plot the recession probability estimates for the model with the highest McFadden R-Sq.**

b) **Based on the plot, and for the portfolio of $1 million that you have created, when would you short S&P500 futures to reduce systematic risk before the 2007-2009 crisis? (DO NOT TRY TO HEDGE WITH OPTIONS BECAUSE YOU HAVE TO PAY OPTION PREMIUM – We want costless hedge)**

c) **How many futures would you use and what is your hedging strategy? Note that your hedging strategy is based on a particular date, and hence do not find the optimal hedge ratio for the whole sample, instead use the sample until the date of hedging.**

d) **What is the net gain/loss (in %) after hedging during the hedge period?**

e) **What is the net gain/loss (in %) without hedge during the above period?**

f) **Do you think that the hedge you proposed was useful?**

g) **Instead of hedging with futures, do you think a new portfolio shifted towards a less risky one would have been more useful?**