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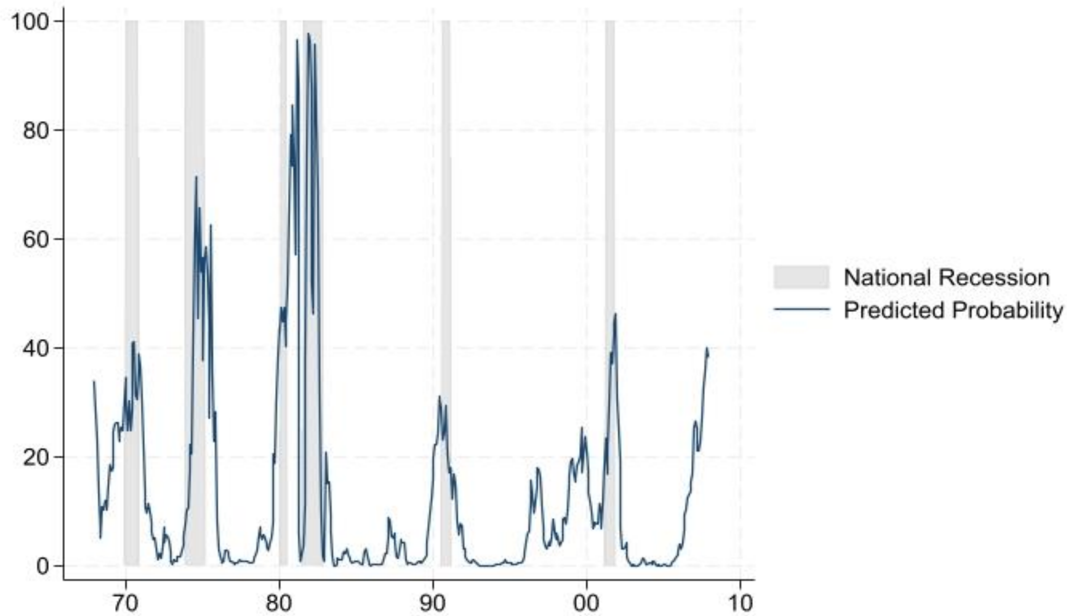
FINANCIAL ECONOMETRICS

Problem Set-4

Q1.

a.




```
. probit usreclead spread if datem >=tm(1959m1) & datem <= tm(2004m12)

Iteration 0:  Log likelihood = -219.36155
Iteration 1:  Log likelihood = -157.12272
Iteration 2:  Log likelihood = -152.64591
Iteration 3:  Log likelihood = -152.61901
Iteration 4:  Log likelihood = -152.61901

Probit regression                                       Number of obs =    552
                                                        LR chi2(1)    = 133.49
                                                        Prob > chi2   = 0.0000
Log likelihood = -152.61901                             Pseudo R2     = 0.3043

------------------------------------------------------------------------------
   usreclead | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
      spread |  -.7375142   .0788315    -9.36   0.000    -.8920211   -.5830074
       _cons |  -.6045698   .0852819    -7.09   0.000    -.7717192   -.4374205
------------------------------------------------------------------------------
```

The estimated parameters are as follows: $\alpha = -0.6045$ and $\beta = -0.7375$. These parameter estimates closely align with those documented in the article, differing only in the fourth decimal place.

b.

```
. reg growthrate_GDP L4.spread, robust

Linear regression                               Number of obs     =        188
                                                F(1, 186)         =      10.75
                                                Prob > F          =     0.0012
                                                R-squared         =     0.0760
                                                Root MSE          =     .82237

------------------------------------------------------------------------------
             |               Robust
growthrate~P | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
      spread |
         L4. |    .183433   .0559374     3.28   0.001     .0730797    .2937864
             |
       _cons |   .6116473   .1086074     5.63   0.000     .3973866     .825908
------------------------------------------------------------------------------
```

```
. reg growthrate_GDI L4.spread, robust

Linear regression                               Number of obs     =        188
                                                F(1, 186)         =      11.03
                                                Prob > F          =     0.0011
                                                R-squared         =     0.0704
                                                Root MSE          =     .78174

------------------------------------------------------------------------------
             |               Robust
growthrate~I | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
      spread |
         L4. |   .1672431   .0503461     3.32   0.001     .0679203    .2665658
             |
       _cons |   .6400699   .0965089     6.63   0.000     .4496772    .8304626
------------------------------------------------------------------------------
```

The statistical analysis reveals that the lag spread exhibits significant correlation in both regression models. Consequently, it appears that the spread holds explanatory value in forecasting recessions, whether utilizing GDP or GDI as the dependent variable. The positive slope indicates that the estimates rise in tandem with an increase in the spread. This finding aligns with the observations made in the article, particularly in the context of comparing the 10-year Bond with the 3-month T-Bill.

c.

```
. reg growthrate_GDP L4.spread L4.growthrate_GDP L4.growthrate_GDI, robust

Linear regression                               Number of obs     =        187
                                                F(3, 183)         =       4.26
                                                Prob > F          =     0.0062
                                                R-squared         =     0.0804
                                                Root MSE          =      .8237

--------------------------------------------------------------------------------
               |               Robust
growthrate_GDP | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
---------------+----------------------------------------------------------------
        spread |
           L4. |   .1856465   .0554234     3.35   0.001     .0762954    .2949975
               |
growthrate_GDP |
           L4. |   .0754082   .1341731     0.56   0.575    -.1893169    .3401332
               |
growthrate_GDI |
           L4. |   -.067856    .148222    -0.46   0.648    -.3602999    .2245878
               |
         _cons |   .5959841   .1337635     4.46   0.000     .3320671    .8599011
--------------------------------------------------------------------------------
```

```
. reg growthrate_GDI L4.spread L4.growthrate_GDP L4.growthrate_GDI, robust

Linear regression                               Number of obs     =        187
                                                F(3, 183)         =       4.71
                                                Prob > F          =     0.0034
                                                R-squared         =     0.0839
                                                Root MSE          =     .77748

--------------------------------------------------------------------------------
               |               Robust
growthrate_GDI | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
---------------+----------------------------------------------------------------
        spread |
           L4. |   .1728412   .0497078     3.48   0.001     .0747671    .2709153
               |
growthrate_GDP |
           L4. |  -.1723254   .1190574    -1.45   0.149    -.4072271    .0625762
               |
growthrate_GDI |
           L4. |   .1408358   .1261372     1.12   0.266    -.1080343     .389706
               |
         _cons |   .6528919   .1181915     5.52   0.000     .4196988    .8860851
--------------------------------------------------------------------------------
```

It is evident that the additional regressors do not contribute significantly to the predictive accuracy of the estimates, as they lack statistical significance even when considering a more lenient significance threshold of 10%. In contrast, the spread emerges as a variable with explanatory power for recessions based on the regression analysis.

d.

```
. varsoc GDP GDI, maxlag(12)

Lag-order selection criteria

   Sample: 1962q1 thru 2005q4                             Number of obs = 176
  +---------------------------------------------------------------------------+
  | Lag |     LL        LR      df    p      FPE       AIC      HQIC      SBIC    |
  |-----+---------------------------------------------------------------------|
  |   0 |  -2727.94                       1.0e+11   31.0221   31.0367   31.0581  |
  |   1 |  -1893.55   1668.8     4  0.000 8.1e+06   21.5858   21.6296   21.6939  |
  |   2 |  -1867.67   51.756     4  0.000 6.3e+06   21.3372   21.4102   21.5173* |
  |   3 |  -1865.08   5.1895     4  0.268 6.4e+06   21.3532   21.4554   21.6053  |
  |   4 |  -1854.47   21.222     4  0.000 6.0e+06*   21.278*  21.4095*  21.6023  |
  |   5 |  -1853.37   2.1859     4  0.702 6.2e+06   21.3111   21.4718   21.7074  |
  |   6 |  -1852.35   2.0557     4  0.726 6.4e+06   21.3448   21.5348   21.8132  |
  |   7 |  -1851.57   1.5575     4  0.816 6.6e+06   21.3814   21.6006   21.9219  |
  |   8 |  -1849.28   4.5798     4  0.333 6.8e+06   21.4009   21.6493   22.0134  |
  |   9 |   -1845.2   8.1559     4  0.086 6.8e+06      21.4   21.6776   22.0845  |
  |  10 |   -1840.9    8.599     4  0.072 6.7e+06   21.3966   21.7035   22.1532  |
  |  11 |  -1839.91   1.9859     4  0.738 7.0e+06   21.4308   21.7669   22.2594  |
  |  12 |  -1834.14   11.543*    4  0.021 6.8e+06   21.4106   21.7759   22.3113  |
  +---------------------------------------------------------------------------+
   * optimal lag
   Endogenous: GDP GDI
    Exogenous: _cons
```

```
. var GDP GDI, lags(2)

Vector autoregression

Sample: 1959q3 thru 2005q4                        Number of obs     =        186
Log likelihood =  -2113.796                       AIC               =   22.79351
FPE            =   2.72e+07                       HQIC              =   22.83567
Det(Sigma_ml)  =   2.55e+07                       SBIC              =   22.89756

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
GDP                   3     100.224   0.9992   241093.6   0.0000
GDI                   3     103.599   0.9992   227668.2   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
GDP          |
         GDP |
         L2. |   .9603275    .082363    11.66   0.000     .7988989    1.121756
             |
         GDI |
         L2. |   .0534576   .0820926     0.65   0.515     -.107441    .2143563
             |
       _cons |   23.78564   19.57997     1.21   0.224    -14.5904     62.16169
-------------+----------------------------------------------------------------
GDI          |
         GDP |
         L2. |   .1329608   .0851362     1.56   0.118    -.0339032    .2998247
             |
         GDI |
         L2. |   .8826544   .0848567    10.40   0.000     .7163382    1.048971
             |
       _cons |   2.130209   20.23924     0.11   0.916    -37.53798    41.79839
------------------------------------------------------------------------------
```

```
. vecrank GDP GDI, trend(constant) lags(2)

Johansen tests for cointegration
Trend: Constant                               Number of obs  = 186
Sample: 1959q3 thru 2005q4                    Number of lags =   2
-------------------------------------------------------------------
                                                           Critical
Maximum                                          Trace        value
   rank  Params           LL  Eigenvalue   statistic           5%
      0       6   -1976.7001           .     18.6971        15.41
      1       9   -1969.6294     0.07321      4.5556         3.76
      2      10   -1967.3515     0.02420
-------------------------------------------------------------------
```

STATA CODE

Q1.

a.
```
clear all
freduse GS10 TB3MS USREC
gen datem = mofd(daten)
format datem %tm
gen time = mofd(daten) + 12
format time %tm
tsset time

gen tbill = 100*(365*TB3MS/100)/(360-91*TB3MS/100)
gen spread = GS10 - tbill
gen usreclead = USREC[_n+12]

probit usreclead spread if datem >= tm(1959m1) & datem <= tm(2004m12)
gen recprob = (normal(_b[_cons] + _b[spread] * spread))*100
gen USREC1 = USREC*100
label variable USREC1 "National Recession"
label variable recprob "Predicted Probability"

twoway (area USREC1 datem, color(gs14)) (tsline recprob, lcolor(navy)) if datem >= tm(1967m1)
& datem <= tm(2006m12), xtitle("") ytitle("") tlabel(, format(%tmYY)) title("US Recession
Probabilities(percent)")
```

b.
```
clear all

freduse GS10 TB3MS GDPC1 A261RX1Q020SBEA
rename GDPC1 GDP
rename A261RX1Q020SBE GDI

generate time = qofd(daten)
format time %tq
drop if missing(GDP)
drop if time < tq(1958q1)
drop if time > tq(2005q4)
tsset time

generate tbill = 100*(365*TB3MS/100)/(360-91*TB3MS/100)
generate spread = GS10 - tbill
generate growthrate_GDP = (log(GDP)-log(L.GDP))*100
generate growthrate_GDI = (log(GDI)-log(L.GDI))*100
```

reg growthrate_GDP L4.spread, robust
predict for_GDP
reg growthrate_GDI L4.spread, robust
predict for_GDI

c. reg growthrate_GDP L4.spread L4.growthrate_GDP L4.growthrate_GDI, robust
predict for_GDP_1c
reg growthrate_GDI L4.spread L4.growthrate_GDP L4.growthrate_GDI, robust
predict for_GDI_1c

d. drop if time <tq(1959q1)
varsoc GDP GDI, maxlag(12)
var GDP GDI, lags(2)
vecrank GDP GDI, trend(constant) lags(2)