Assignment 1

From the given data set, estimate the following models:

Capital Asset Pricing Model (CAPM)

CAPM: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \varepsilon_{jt} \quad (1)$$

Fama & French three-factor Model (FF)

Fama & French: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \varepsilon_{jt} \quad (2)$$

Where:
- r_{jt} = excess return on portfolio j at time t and
- r_{mt} = excess return on market portfolio at time t – representing market risk premium.
- r_{smbt} = return on a small-stock portfolio minus the return on a large-stock portfolio (Small Minus Big) at time t – representing size premium.
- r_{hmlt} = return on a value-stock portfolio minus the return on a growth-stock portfolio (High Minus Low) at time t – representing value premium.

(1) Determine whether there exists significant Jensen Alpha.
(2) Determine whether there exists significant size premium.
(3) Determine whether there exists significant growth (value) premium.
(4) Compare CAPM and FF models and determine which model is the most appropriated model. why?

To study calendar effect (January effects) from the data set, estimate the following models:

$$r_{jt} = \alpha_j + \gamma_j D_{1t} + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \varepsilon_{jt} \quad (3)$$

where: $D_{1t} = 1$ on January and $= 0$ otherwise.

(5) Determine whether there exist significant January effects.
(6) Perform Chow-test whether January and other month share the same structure of the Fama-French model (2).

CAPM: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \varepsilon_{jt} \quad (1)$$

CAPM Model

```
. reg rj rm

      Source |       SS       df       MS              Number of obs =   11959
-------------+------------------------------           F(  1, 11957) =12452.87
       Model |  11499.8872     1  11499.8872           Prob > F      =  0.0000
    Residual |  11041.9647 11957  .923472839           R-squared     =  0.5102
-------------+------------------------------           Adj R-squared =  0.5101
       Total |  22541.8519 11958  1.88508546           Root MSE      =  .96097

------------------------------------------------------------------------------
          rj |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          rm |   .9969055   .0089335   111.59   0.000     .9793945    1.014417
       _cons |   .0237072   .0087955     2.70   0.007     .0064665    .0409478
------------------------------------------------------------------------------
```

Fama & French: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \varepsilon_{jt} \quad (2)$$

Fama & French (FF) Model

```
. reg rj rm smb hml

      Source |       SS       df       MS              Number of obs =   11959
-------------+------------------------------           F(  3, 11955) = 7735.91
       Model |  14877.8302     3  4959.27674           Prob > F      =  0.0000
    Residual |  7664.02169 11955  .641072496           R-squared     =  0.6600
-------------+------------------------------           Adj R-squared =  0.6599
       Total |  22541.8519 11958  1.88508546           Root MSE      =  .80067

------------------------------------------------------------------------------
          rj |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          rm |    1.203507   .0079851   150.72   0.000     1.187854    1.219159
         smb |    .7513001   .0147413    50.97   0.000     .7224047    .7801955
         hml |    .9001084   .0157877    57.01   0.000      .869162    .9310548
       _cons |   -.0078015   .0073423    -1.06   0.288    -.0221936    .0065906
------------------------------------------------------------------------------
```

(1) Determine whether there exists significant Jensen Alpha.
According to CAPM, there exists the Jensen Alpha `(t=2.70 & p-value=0.007)`. However, based on FF, there is no Jensen Alpha `(t=-1.06 & p-value=0.288)`.

(2) Determine whether there exists significant size premium.
According to FF, there exists significant size premium `(t=50.97 & p-value=0.000)`.

(3) Determine whether there exists significant growth (value) premium.
According to FF, there exists significant growth premium `(t=57.01 & p-value=0.000)`.

(4) Compare CAPM and FF models and determine which model is the most appropriated model. why?

Test FF model vs CAPM

```
. test smb hml

 ( 1)  smb = 0
 ( 2)  hml = 0

       F(  2, 11955) = 2634.60
            Prob > F =    0.0000
```

According to the above test, the FF model is more appropriate since both size and growth premium coefficients are significant.

To study calendar effect (January effects) from the data set, estimate the following models:

$$r_{jt} = \alpha_j + \gamma_j D_{1t} + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \varepsilon_{jt} \qquad (3)$$

January Effect

```
. reg rj rm smb hml d1

      Source |       SS       df       MS              Number of obs =   11959
-------------+------------------------------           F(  4, 11954) = 5802.20
       Model |  14878.4877     4  3719.62193            Prob > F      =  0.0000
    Residual |  7663.36419 11954  .641071122            R-squared     =  0.6600
-------------+------------------------------           Adj R-squared =  0.6599
       Total |  22541.8519 11958  1.88508546            Root MSE      =  .80067

------------------------------------------------------------------------------
          rj |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          rm |   1.203741   .0079884   150.69   0.000     1.188082    1.219399
         smb |   .7521106    .014763    50.95   0.000     .7231726    .7810485
         hml |   .9007457   .0158002    57.01   0.000     .8697748    .9317167
          d1 |  -.0270271   .0266873    -1.01   0.311    -.0793385    .0252843
       _cons |  -.0056035   .0076563    -0.73   0.464    -.0206112    .0094042
------------------------------------------------------------------------------
```

(5) Determine whether there exist significant January effects.
According to the above estimated result, there is no January effects (`t=-1.01 & p-value=0.311`).

Chow test using dummy variables technique

```
. g drm=d1*rm

. g dsmb=d1*smb

. g dhml=d1*hml

. reg rj rm drm smb dsmb hml dhml d1

      Source |       SS       df       MS              Number of obs =   11959
-------------+------------------------------           F(  7, 11951) = 3320.36
       Model |  14887.1008     7  2126.72868            Prob > F      =  0.0000
    Residual |  7654.75117 11951  .640511352            R-squared     =  0.6604
-------------+------------------------------           Adj R-squared =  0.6602
       Total |  22541.8519 11958  1.88508546            Root MSE      =  .80032

------------------------------------------------------------------------------
          rj |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          rm |   1.210504   .0083216   145.46   0.000     1.194192    1.226816
         drm |  -.0821645   .0296057    -2.78   0.006    -.1401965   -.0241326
         smb |   .7604496    .015365    49.49   0.000     .7303317    .7905675
        dsmb |  -.0965614   .0554495    -1.74   0.082    -.2052515    .0121288
         hml |   .9155853   .0166293    55.06   0.000     .8829891    .9481814
        dhml |  -.1485051   .0532674    -2.79   0.005    -.2529178   -.0440924
          d1 |  -.0044467   .0274878    -0.16   0.871    -.0583272    .0494338
       _cons |  -.0060918   .0076543    -0.80   0.426    -.0210954    .0089118
------------------------------------------------------------------------------

. test drm dsmb dhml d1

 ( 1)  drm = 0
 ( 2)  dsmb = 0
 ( 3)  dhml = 0
 ( 4)  d1 = 0

       F(  4, 11951) =    3.62
            Prob > F =    0.0059
```

(6) Perform Chow-test whether January and other month share the same structure of the Fama-French model (2).
According to the above Chow-test (using dummy variable technique), January and other months do not share the same structure of the FF model. Therefore, the models of January and other months should be estimated separately.