momentum premium.

(a) From CAPM, determine top 3 mutual fund in term of their performance based on Jensen Alpha.

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From CAPM, the top 3 mutual fund are fund 4 : α = 0.4191

fund 6 : α = 0.2460 fund 8 : α = 0.2274

(b) From FF, determine top 3 mutual fund in term of their performance based on Jensen Alpha.

From FF, the top 3 mutual funds are fund 4 : α = 0.5414

fund 6 : α = 0.2827 fund 5 : α = 0.2452

(c) From Carhart, determine top 3 mutual fund in term of their performance based on Jensen Alpha.

From Carhart, the top 3 mutual funds are fund 5 : α = 1.1058

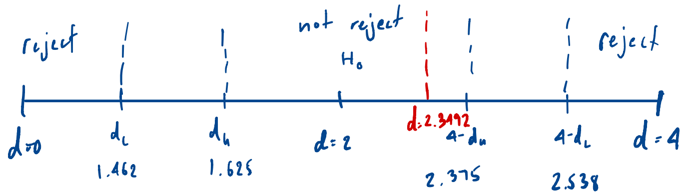
fund 17 : α = 0.8892 fund 3 : α = 0.8596.

(d) From the estimated result of Carhart four-factor model (3) of mutual fund #1, evaluate whether there exist Autocorrelation and Multicollinearity problem or not? Which model between Carhart or FF should be employed in this case? Why? Also, make evaluation of the estimated results of Carhart model in term of (i) sign and meaning of the estimated coefficients; (ii) overall test; (iii) coefficient of determination; and (iv) individual test.

To check for Autocorrelation, use d-statistic

d-stat (5, 120) = 2.349188

$H_0: \rho = 0$ H_1: H_0 isn't true.



d_L = 1.462
d_u = 1.625

∴ Fail to reject H_0 at 2% significant level, therefore it doesn't contain auto correlation problem.

For multicollinearity, I evaluate the t-test whether any insinificance of the β are from VIF or not. β rmrf, β smb, β hml are all significant at 5% level, however, β wml is insignificant.

To check t-test × $\sqrt{VIF}$ = -1.43 × $\sqrt{1}$ = -1.43

β wml is still insignificant, therefore, it doesn't have multicollinearity problem.

In the case of fund #1, $\bar{R}^2$ for FF is 0.8118841,

$\bar{R}^2$ for Carhart is 0.8135 4415. However, the βwml is insignificant and the adjusted R^2 for Carhart is not higher than a significant amount. Therefore, FF should be used in this case.

Sign & meaning : β_{rmt} = 88.37442 → when r_{mt} increase by 1 unit, r_{jt} is predicted to increase by 88.37442 unit.

β_{smb} = -30.55523 → when r_{smb} increase by 1 unit, r_{jt} is predicted to decrease by 30.55523 unit

β_{hml} = -29.55418 → when r_{hml} increase by 1, r_{jt} is predicted to decrease by 29.55418

β_{wml} = -16.89643 → when r_{wml} increase by 1, r_{jt} is predicted to decrease by 16.89643.

overall test

$H_0: \beta_{rmrf} = \beta_{smb} = \beta_{hml} = \beta_{wml} = 0$ H_1: H_0 isn't true

$F(4, 115) = 130.81$

P-value = 0.0000

∴ Fail to reject H_0, therefore the coefficient are all statistically significant.

coefficient of determination

$R^2 = 0.8198$ this means that the independent variables can explained 81.98 % of the variation in the dependent variable.

individual test

β_{rmrf} p-value = 0.000 → β_{rmrf} is significant

β_{smb} p-value = 0.047 → β_{smb} is insignificant at 1%

β_{hml} p-value = 0.045 → β_{hml} is insignificant at 1%

β_{wml} p-value = 0.157 → β_{wml} is insignificant at 10%.

determination, and (IV) individual test.

(e) Based on (a), (b), and (c), which result is the most appropriated one? Why?

FF is the most appropriate model from the reason that at 5% significant level r_{wml} is insignificant. So by adding r_{wml} into the model, it doesn't help explaining the model bestter,

Another reason is that the adjusted R^2 for FF is only just a little bit lower than the adjusted R^2 for Carhart, therefore using Carhart won't help to explain the dependent variable better.

```
      name:  <unnamed>
       log:  C:\Users\User\Desktop\426\2nd try.smcl
  log type:  smcl
 opened on:  26 Jan 2021, 14:58:50

. use "C:\Users\User\Desktop\426\assign1.dta", clear

. do "C:\Users\User\AppData\Local\Temp\STD00000000.tmp"

. set more off

. mat Alpha_CAPM=(0,9999)

. forvalue i=1(1)20 {
  2. qui reg r`i' rmrf
  3. est store capm`i'
  4. mat beta=e(b)
  5. sca a_capm`i'=el(beta,1,2)
  6. mat Alpha_CAPM=(Alpha_CAPM \ `i',a_capm`i')
  7. }

. est table capm*, star(.1 .05 .01) stat(N rss F r2 r2_a)

-------------------------------------------------------------------------------------------
> -----------------
    Variable |    capm1         capm2         capm3         capm4         capm5
>     capm10
-------------+-----------------------------------------------------------------------------
> -----------------
        rmrf |  86.67481***    .33259034     79.458292***  71.566194***  89.883716***
>   95.818659***
       _cons | -.28045261      .02705237     .04241345     .41910739*     .1533913
>   .15557323
-------------+-----------------------------------------------------------------------------
> -----------------
           N |        120           120           120           120           120
>        120
         rss |  408.66469      17.49366     608.13953     723.83913     444.17823
>   1155.1959
           F |  503.19828     .17308485     284.18142     193.68422     497.88063
>   217.55296
          r2 |  .81004455     .00146467     .70660007      .6214117     .80840443
>   .64834165
        r2_a |  .80843476    -.00699749     .70411363     .61820332     .80678074
>   .64536149
-------------------------------------------------------------------------------------------
> -----------------

> p<.05; *** p<.01


-------------------------------------------------------------------------------------------
> -----------------
    Variable |    capm11        capm12        capm13        capm14        capm15
>     capm20
-------------+-----------------------------------------------------------------------------
> -----------------
        rmrf |  92.431281***  103.15122***  95.215162***  95.059925***  99.733614***
>   90.702947***
       _cons |  .19464246     .03145185     .13681104     .17849533     .09946436
>   .04748425
-------------+-----------------------------------------------------------------------------
> -----------------
           N |        120           120           120           120           120
>        120
         rss |  425.2018      298.82029     273.31705     271.52934     1344.5332
>   501.25227
           F |  550.00079     974.67347      907.9584     910.95859     202.50328
>   449.26947
          r2 |   .8233535     .89200799     .88498559     .88532094     .63182904
>   .79198598
```

```
       r2_a |   .8218565       .89109281       .88401089       .88434909       .62870894
>   .79022315
-------------+--------------------------------------------------------------------------------
> ----------------

> p<.05; *** p<.01

. mat list Alpha_CAPM

Alpha_CAPM[21,2]
             c1          c2
 r1           0        9999
 r2           1  -.28045261
 r3           2   .02705237
 r4           3   .04241345
 r5           4   .41910739
 r6           5    .1533913
 r7           6    .2460271
 r8           7   .06639442
 r9           8   .22738701
r10           9   .03444878
r11          10   .15557323
r12          11   .19464246
r13          12   .03145185
r14          13   .13681104
r15          14   .17849533
r16          15   .09946436
r17          16   .02742681
r18          17   .03352088
r19          18   .09933407
r20          19   .00020766
r21          20   .04748425

.
end of do-file

. do "C:\Users\User\AppData\Local\Temp\STD00000000.tmp"

. set more off

. mat Alpha_FF=(0,9999)

. forvalue i=1(1)20 {
  2. qui reg r`i' rmrf smb hml
  3. est store FF`i'
  4. mat beta=e(b)
  5. sca a_FF`i'=el(beta,1,4)
  6. mat Alpha_FF=(Alpha_FF \ `i',a_FF`i')
  7. }

. est table FF*, star(.1 .05 .01) stat(N rss F r2 r2_a)

-------------+--------------------------------------------------------------------------------
> ----------------
    Variable |     FF1             FF2             FF3             FF4             FF5
>      FF10
-------------+--------------------------------------------------------------------------------
> ----------------
        rmrf |  88.458388***    .15618323       75.024622***    61.286991***     82.28291***
>   88.602574***
         smb | -30.483305**     .60757858        1.092207       53.954532***    17.510869
>   28.144644
         hml | -29.652027**     .01421362      -16.831267       23.318083       -9.8956295
>   4.5713118
       _cons | -.30036799*      .02917021       .09651371       .54137257**     .24517545
>   .24200303
-------------+--------------------------------------------------------------------------------
> ----------------
           N |       120             120             120             120             120
>         120
         rss |  394.50442       17.442327       557.60582       576.53565       333.87253
>   1073.6006
```

```
           F |  172.19625       .17068035       105.06507       89.562091       229.82317
>   79.645306
          r2 |  .81662652       .00439475       .73098031       .69845558       .85598462
>   .67318044
        r2_a |   .8118841      -.02135366        .7240229       .69065701       .85226008
>   .66472821
-------------+---------------------------------------------------------------------------
> ----------------
> p<.05; *** p<.01


-------------+---------------------------------------------------------------------------
> ----------------
    Variable |    FF11            FF12            FF13            FF14            FF15
>      FF20
-------------+---------------------------------------------------------------------------
> ----------------
        rmrf |  88.395815***   106.51349***    95.41369***    95.023693***    96.70656***
>   84.673247***
         smb |  21.866246      -16.608141      -9.3380346      -6.5211564       32.201686
>   11.773332
         hml |  9.9841502      -6.3663201      -10.507753      -8.0541036       26.643361
>  -10.417874
       _cons |  .24259989      -.00860432       .13495997       .17933912       .13446597
>   .12042667
-------------+---------------------------------------------------------------------------
> ----------------
           N |        120             120             120             120             120
>         120
         rss |  402.73013       282.71843        271.3924       270.18671        1328.344
>   428.36742
           F |  192.44011       339.77687       299.90727        300.1817        67.63698
>   178.84575
          r2 |  .83268917       .89782712        .8857955         .885888       .63626209
>   .82223237
        r2_a |  .82836216       .89518472       .88284194       .88293682       .62685507
>   .81763493
-------------+---------------------------------------------------------------------------
> ----------------
> p<.05; *** p<.01

. mat list Alpha_FF

Alpha_FF[21,2]
             c1          c2
 r1           0        9999
 r2           1  -.30036799
 r3           2   .02917021
 r4           3   .09651371
 r5           4   .54137257
 r6           5   .24517545
 r7           6   .28268096
 r8           7   .06469084
 r9           8   .24142393
r10           9   .01544377
r11          10   .24200303
r12          11   .24259989
r13          12  -.00860432
r14          13   .13495997
r15          14   .17933912
r16          15   .13446597
r17          16   .08765823
r18          17   .11427555
r19          18   .15543046
r20          19   .07292389
r21          20   .12042667
```

```
.
end of do-file

. do "C:\Users\User\AppData\Local\Temp\STD00000000.tmp"

. set more off

. mat Alpha_Car=(0,9999)

. forvalue i=1(1)20 {
  2. qui reg r`i' rmrf smb hml wml
  3. est store Car`i'
  4. mat beta=e(b)
  5. sca a_Car`i'=el(beta,1,5)
  6. mat Alpha_Car=(Alpha_Car \ `i',a_Car`i')
  7. }

. est table Car*, star(.1 .05 .01) stat(N rss F r2 r2_a)

──────────────┬──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
    Variable  │    Car1            Car2            Car3            Car4            Car5
>      Car10
──────────────┼──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
        rmrf  │  88.37442***     .17216893     74.961681***    61.414372***    82.211925***
>   88.67622***
         smb  │ -30.555228**     .62127126     1.0382938      54.063641***    17.450066
>  28.207726
         hml  │ -29.554175**    -.00441541    -16.757917       23.169639      -9.8129059
>  4.4854877
         wml  │ -16.896434       3.2167406    -12.665517       25.632471*     -14.28416
>  14.819552
       _cons  │  .71766532      -.16464281     .85962846     -1.0030189       1.1058157
>  -.6508953
──────────────┼──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
           N  │        120             120             120             120             120
>        120
         rss  │  387.65219       17.193972       553.75558       560.76597       328.97529
>  1068.3294
           F  │   130.8052       .54401476       78.862559       69.273695       173.85324
>  59.653079
          r2  │  .81981157       .01857085       .73283787       .70670357       .85809703
>  .67478508
        r2_a  │  .81354415      -.01556582       .72354528       .69650195       .85316128
>  .66347326
──────────────┴──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────

> p<.05; *** p<.01


──────────────┬──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
    Variable  │    Car11           Car12           Car13           Car14           Car15
>      Car20
──────────────┼──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
        rmrf  │  88.493872***   106.54016***    95.452446***    95.059483***    96.765085***
>  84.624416***
         smb  │  21.950238      -16.585297      -9.3048377      -6.4905003      32.251816
>  11.731505
         hml  │  9.8698788      -6.3973991      -10.552918      -8.0958114      26.575159
> -10.360968
         wml  │  19.731647       5.3665241       7.7987449       7.2018442      11.776732
> -9.8261046
       _cons  │ -.94625889      -.33194474      -.3349251       -.25458186      -.57509829
>  .71246294
──────────────┼──────────────────────────────────────────────────────────────────────────────────────
> ─────────────────
           N  │        120             120             120             120             120
```

```
>         120
        rss │  393.38536       282.02719       269.93261       268.94182       1325.0152
>      426.05
          F │  147.16777       253.32549       224.35281       224.36166          50.489
>   133.85767
         r2 │  .83657138       .89807693       .88640979       .88641377       .63717361
>   .82319408
       r2_a │   .8308869       .89453178       .88245883       .88246294       .62455357
>    .8170443
            │
──────────────────────────────────────────────────────────────────────────────────────────
> ────────────────

> p<.05; *** p<.01

. mat list Alpha_Car

Alpha_Car[21,2]
             c1          c2
 r1           0        9999
 r2           1   .71766532
 r3           2  -.16464281
 r4           3   .85962846
 r5           4  -1.0030189
 r6           5   1.1058157
 r7           6  -.00363444
 r8           7   .25590768
 r9           8  -.03462485
r10           9   -.2831535
r11          10   -.6508953
r12          11  -.94625889
r13          12  -.33194474
r14          13   -.3349251
r15          14  -.25458186
r16          15  -.57509829
r17          16   .79030403
r18          17   .88918966
r19          18  -.14240538
r20          19   .72254197
r21          20   .71246294

.
end of do-file

. log off
      name:  <unnamed>
       log:  C:\Users\User\Desktop\426\2nd try.smcl
  log type:  smcl
 paused on:  26 Jan 2021, 15:03:34
──────────────────────────────────────────────────────────────────────────────────────────
```

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   14.0   Copyright 1985-2015 StataCorp LP
  Statistics/Data Analysis            StataCorp
                                      4905 Lakeway Drive
     MP - Parallel Edition            College Station, Texas 77845 USA
                                      800-STATA-PC        http://www.stata.com
                                      979-696-4600        stata@stata.com
                                      979-696-4601 (fax)

Single-user 8-core Stata perpetual license:
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Notes:
      1.  Unicode is supported; see help unicode_advice.
      2.  More than 2 billion observations are allowed; see help obs_advice.
      3.  Maximum number of variables is set to 5000; see help set_maxvar.

. use "C:\Users\User\Desktop\426\assign1.dta", clear

. reg r1 rmrf smb hml wml

      Source |       SS           df       MS      Number of obs   =       120
-------------+----------------------------------   F(4, 115)       =    130.81
       Model |    1763.719         4   440.92975   Prob > F        =    0.0000
    Residual |  387.652185       115  3.37088857   R-squared       =    0.8198
-------------+----------------------------------   Adj R-squared   =    0.8135
       Total |  2151.37118       119  18.0787494   Root MSE        =     1.836

------------------------------------------------------------------------------
          r1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        rmrf |   88.37442   4.132204    21.39   0.000     80.18932    96.55952
         smb |  -30.55523   15.20777    -2.01   0.047     -60.6789   -.4315607
         hml |  -29.55418   14.55813    -2.03   0.045    -58.39103   -.7173227
         wml |  -16.89643    11.8509    -1.43   0.157    -40.37078     6.57791
       _cons |   .7176653   .7344903     0.98   0.331    -.7372186    2.172549
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF  
-------------+----------------------
         smb |     11.39    0.087771
         hml |     10.87    0.092012
        rmrf |      1.18    0.851025
         wml |      1.00    0.998808
-------------+----------------------
    Mean VIF |      6.11

. reg r1 rmrf smb hml

      Source |       SS           df       MS      Number of obs   =       120
-------------+----------------------------------   F(3, 116)       =    172.20
       Model |  1756.86676         3  585.622255   Prob > F        =    0.0000
    Residual |  394.504419       116  3.40090016   R-squared       =    0.8166
-------------+----------------------------------   Adj R-squared   =    0.8119
       Total |  2151.37118       119  18.0787494   Root MSE        =    1.8442

------------------------------------------------------------------------------
          r1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        rmrf |   88.45839   4.150136    21.31   0.000     80.23852    96.67826
         smb |  -30.48331   15.27524    -2.00   0.048    -60.73783   -.2287763
         hml |  -29.65203   14.62263    -2.03   0.045    -58.61399   -.6900658
       _cons |   -.300368   .1729078    -1.74   0.085    -.6428337    .0420977
------------------------------------------------------------------------------
```

```
. reg r1 rmf
variable rmf not found
r(111);

. reg r1 rmrf

      Source |       SS           df       MS      Number of obs   =       120
-------------+----------------------------------   F(1, 118)       =    503.20
       Model |   1742.7065         1   1742.7065   Prob > F        =    0.0000
    Residual |  408.664685       118  3.46326004   R-squared       =    0.8100
-------------+----------------------------------   Adj R-squared   =    0.8084
       Total |  2151.37118       119  18.0787494   Root MSE        =     1.861

------------------------------------------------------------------------------
          r1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        rmrf |   86.67481   3.863877    22.43   0.000     79.02328    94.32634
       _cons |  -.2804526   .1734399    -1.62   0.109    -.6239108    .0630056
------------------------------------------------------------------------------

.
```