Assignment 1
Review OLS

Due 28/1/2021

From the given data set, `assign1.dta`, 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: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \varepsilon_{jt} \quad (2)$$

Carhart four-factor Model

Carhart: $$r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \beta_{j2} r_{smbt} + \beta_{j3} r_{hmlt} + \beta_{j4} r_{wmlt} + \varepsilon_{jt} \quad (3)$$

Where: r_{jt} = excess return on mutual fund j at time t and j = 1, 2, …, 20.

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.

r_{wmlt} = return on a winners portfolio minus the return on a losers portfolio (Winners Minus Losers) at time t – representing momentum premium.

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

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

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

(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.

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

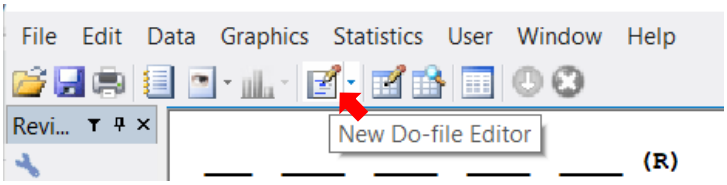
Hint: In order to speed up your analysis, you can employ the loop command by using `forvalue` *command, as follows:*

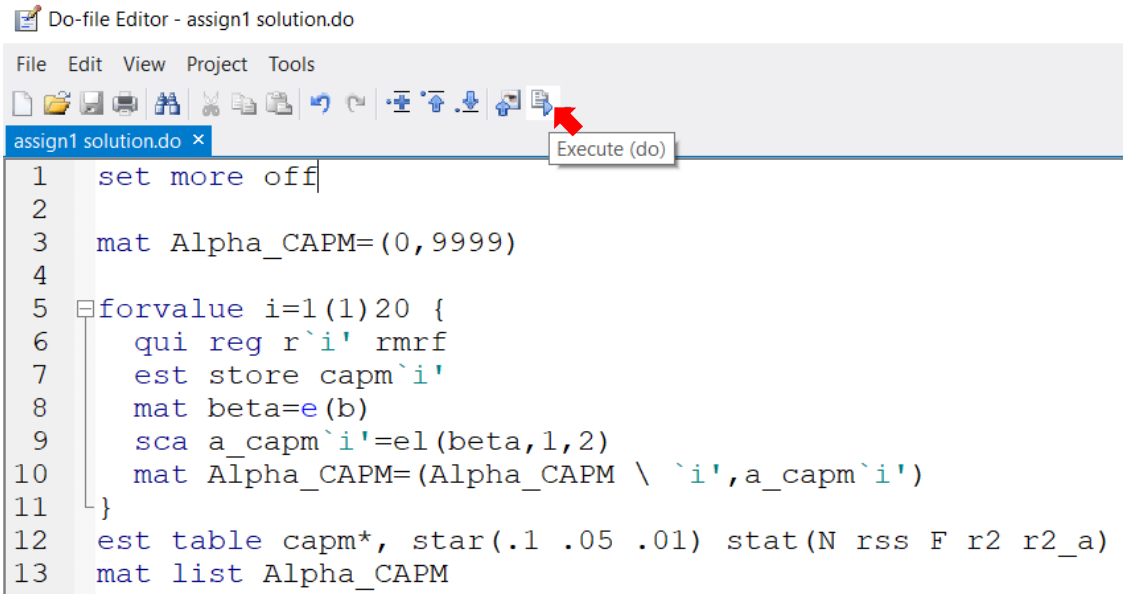
Example do-file command

```
set more off

mat Alpha_CAPM=(0,9999)

forvalue i=1(1)20 {
  qui reg r`i' rmrf
  est store capm`i'
  mat beta=e(b)
  sca a_capm`i'=el(beta,1,2)
  mat Alpha_CAPM=(Alpha_CAPM \ `i',a_capm`i')
}
est table capm*, star(.1 .05 .01) stat(N rss F r2 r2_a)
mat list Alpha_CAPM
```





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

Based on Jensen Alpha, top 3 funds are fund #4, #6, and #8

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

From FF, top 3 funds are #4, #6, and #5

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

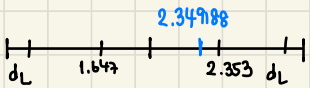
From Carhart, top 3 funds are #5, #17, and #3

(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.

- Multicollinearity : VIF value of smb & hml are higher than 5 which is an evident of multicolinearity
∴ we can conclude that the model has multicollinearity

- Autocorrelation : From dwatson test

(5, 100)



From 2-sided test, we cannot reject H_0: $\rho = 0$. Hence, the test suggests that there is no autocorrelation.

- Carhart or FF? : P-value of wml is 0.1566. ∴ we can conclude that wml is insignificant. Therefore, in this case, FF should be used.

- (i) sign & meaning of coefficients
: smb = -30.55523 means that, if monthly premium of the size factor increases by 1, return is estimated to

decreare by 30.55523

hml = -29.55418 means that, if monthly premium of the book to market factor increases by 1, return is estimated to decrease by 29.55418

rmrf = 88.37442 means that, if monthly return of CRSP value-weighted index less the risk-free rate increase by 1, return is estimated to increase by 88.37442

wml = -16.89643 means that, if monthly premium on winner minus losers increases by 1, return is expected to decrease by 16.89643.

- (ii) Overall test : From F-test, p-value of rmrf = smb = hml = wml = 0 is 0.000. Hence, this model is significant overall.

- (iii) coefficient of determination : R-square is 0.8198

- (iv) individual test : p-value of rmrf is 0.000. Hence, significant
smb is 0.0469. Hence, insignificant
hml is 0.0447. Hence, insignificant
wml is 0.1566. Hence, insignificant

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

Let "appropriate" means all variables have p-value less than .05

After running r1 with 3 methods, the only model with p-value less than 0.05 is FF three factors model.

Hence, I would say that FF is the most appropriate model.