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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?

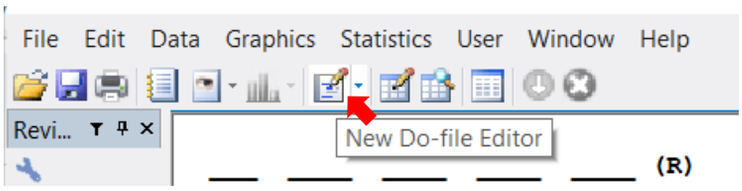
Hint: In order to speed up your analysis, you can employ the loop command by using `forvalue` *command, as follows:*

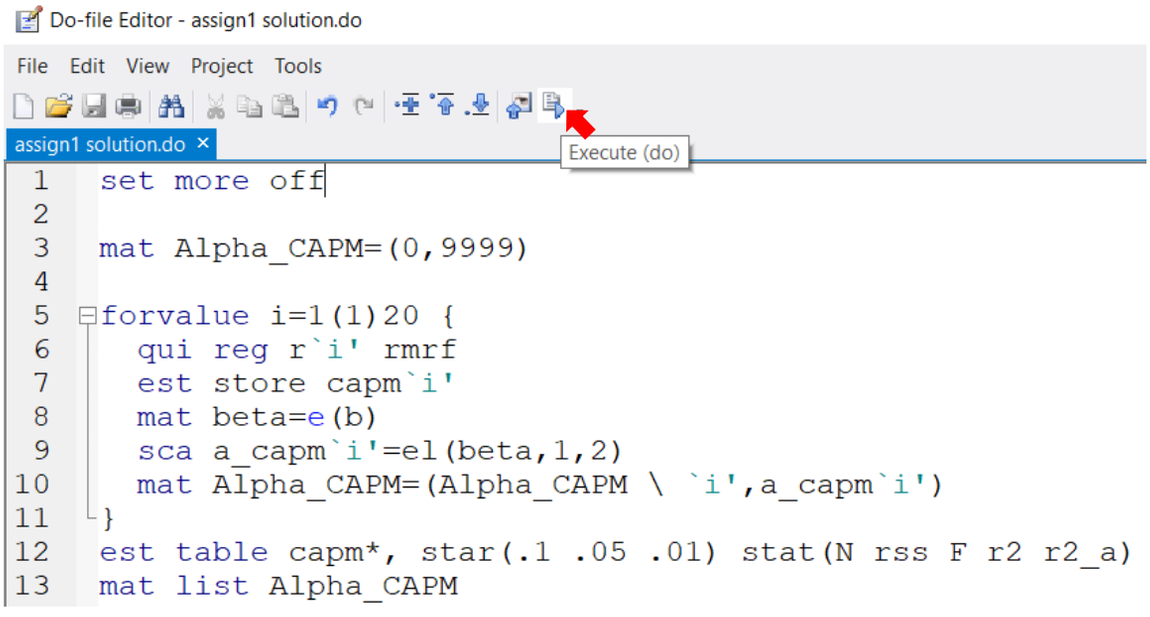
Example do-file command

```
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 with CAPM and log file the top 3 funds are number 4, 8 and 11 respectively which their alpha equal to 0.419, 0.227 and 0.195 #

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

based on Jensen Alpha with FF and log file the top 3 funds are number 4, 6 and 5 respectively which their alpha equal to 0.541, 0.283 and 0.245 #

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

based on Jensen Alpha with CH and log file the top 3 funds are number 5, 17 and 3 respectively which their alpha equal to 1.106, 0.889 and 0.860 #

(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 test wheter the model have multicollinearity or not? using VIF as the criteria

smb's VIF = 11.39 which $|t|\sqrt{VIF} \geq 2$

hml's VIF = 10.87 which $|t|\sqrt{VIF} \geq 2$

rmrf's VIF = 1.18 which $|t|\sqrt{VIF} \geq 2$

wml's VIF = 1.03 which $|t|\sqrt{VIF} < 2$

So, the model have multicollinearity

for the auto correlation according to durbin watson test the model don't have autocorrelation (since 2 < d-stats < 4-du)

and to determine whether we should deploy FF or CH model. We have to test for multicollinearity and Autocorrelation first

for the auto correlation according to durbin watson test the model don't have autocorrelation (since $2 < d\text{-stats} < 4\text{-du}$)

and for multicollinearity

smb's VIF = 11.39 which $|H\sqrt{VIF} \geq 2$

hml's VIF = 10.87 which $|H\sqrt{VIF} \geq 2$

rmrf's VIF = 1.17 which $|H\sqrt{VIF} \geq 2$

So, the model have multicollinearity

which is the same as Carhart model

So, we have to compare in more detail

① Sign and meaning of estimate coefficients

CH: $r_1 = \beta_0 + \beta_1 r_{mrf} - \beta_2 smb - \beta_3 hml - \beta_4 wml$

FF: $r_1 = -\beta_0 + \beta_1 r_{mrf} - \beta_2 smb - \beta_3 hml$

Both models have similar sign

② Overall test

Both models are statistically significant in overall test

③ Coefficient of determination

to eliminate from non-decreasing R^2 problem we use Adjusted R^2 instead

However, both models have very close number of R^2

④ for the individual test

FF: insignificant on β_0

CH: insignificant on β_0 and β_4

from this result it's the sign that β_4 is irrelavent variable since it's not significant and also should be eliminated since there's no sign of multicollinecurity on WML according to the VIF.

which set the same result when using encompassing test.

so, FF model should be deployed in this case.

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

the most appropiated one is (b) ✱
which is FF model because

① CAPM will have endogeneity problem
since there're multicollinearity in FF model
which mean that Independent variable are correlated
and if we eliminate the variable the $E(U|x) \neq 0$

② CH have irrelevant variable that can be eliminated
with not making the model to be biased.

So, the FF model is the best in this case