

Assignment 1
Review OLS

Due 28/1/2021

From the given data set, `assign1.dta`, estimate the following models:

Capital Asset Pricing Model (CAPM)

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

Fama & French three-factor Model (FF)

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

Carhart four-factor Model

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

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

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:

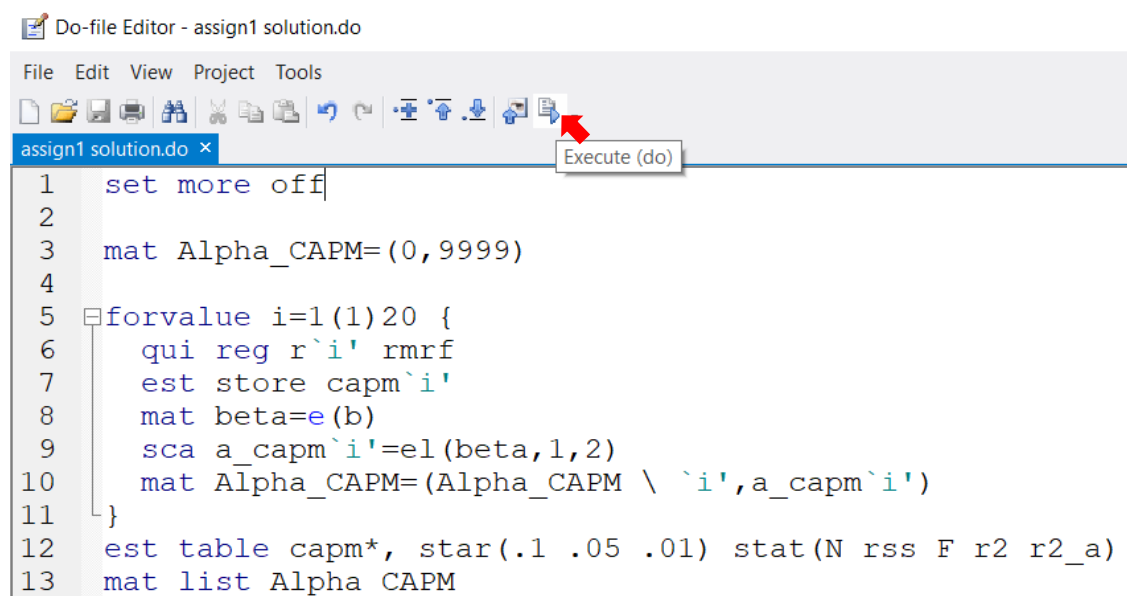
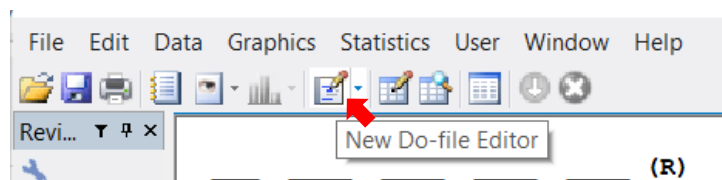
Example do-file command

```
set more off

mat Alpha_CAPM=(0,9999)

forvalue i=1(1)20 {
  qui reg r`i' rmlf
  est store capm`i'
  mat beta=e(b)
  sca a_capm`i'=e1(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.
- (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.

- A) fund#4 Fund #6 Fund#8
- B) fund #4 Fund#6 Fund#5
- C) Fund #5 Fund#17 Fund#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.

<ul style="list-style-type: none"> • From Carhart Model (Mutual fund 1) d-statistic = 2.349138 • From table at 5% significant, n:120 K=4 $d_L = 1.679$ $d_U = 1.988$ <p style="text-align: center;"> 1.679 1.788 2.212 2.349138 <small>(4-1788)</small> </p> <p> $H_0 : \rho = 0$ $H_a : \rho \neq 0$ $\therefore H_0$ is rejected at 5% significant, there is an autocorrelation problem </p>	<p>From Carhart 1, we can conclude that overall test is significant, but for individual test, 3 variables (omb, hnd and umh) are insignificant at 5% level. Therefore, there is a signal of multicollinearity</p>
<ul style="list-style-type: none"> • From FF Model (Mutual fund 1) d-statistic = 2.342202 • From table at 5% significant, n:120 K=3 $d_L = 1.693$ $d_U = 1.974$ <p style="text-align: center;"> 1.693 1.774 2.226 2.342 </p> <p> $H_0 : \rho = 0$ $H_a : \rho \neq 0$ $\therefore H_0$ is rejected at 5% significant, there is an autocorrelation problem </p>	<p>From FF 1, we can conclude that overall test is significant, but for individual test, 2 variables (omb and hnd) are insignificant at 5% level. Therefore, there is a signal of multicollinearity</p>

- Since both models occur Autocorrelation and Multicollinearity problems, We can use adjusted R^2 to choose the model instead. As a result, Cashast Model which has higher adjusted R^2 should be employed in this case. #

(i) sign and meaning

For smt, it can be interpreted that 1 point change in market risk premium will affect α_1 to increase by 89.87 point	For smb, it can be interpreted that 1 point change in size premium will affect α_1 to decrease by 30.56 point
For hml, it can be interpreted that 1 point change in value premium will affect α_1 to decrease by 29.55 point	For wml, it can be interpreted that 1 point change in momentum premium will affect α_1 to decrease by 16.9 point

• Overall test

$H_0 : \beta_1 = \dots = \beta_4 = 0$

$H_a : H_0$ is not true

$F(4, 116) = 150.81$

\therefore F-test. H_0 is rejected at 5% significant.

- $R^2 = 0.8198$

The variation of α_1 can be explained by the variation in the model by 81.98%.

- Individual test (at 5% significant)

① smt	② smb	③ hml
$H_0 : \beta_1 = 0$	$H_0 : \beta_2 = 0$	$H_0 : \beta_3 = 0$
$H_a : \beta_1 \neq 0$	$H_a : \beta_2 \neq 0$	$H_a : \beta_3 \neq 0$
$p > t : 0.000 < 0.025$	$p > t : 0.047 > 0.025$	$p > t : 0.045 > 0.025$
H_0 is rejected	H_0 is not rejected	H_0 is not rejected
smt is statistically significant.	smb is statistically insignificant	smb is statistically insignificant
④ wml		
$H_0 : \beta_4 = 0$		
$H_a : \beta_4 \neq 0$		
$p > t : 0.157 > 0.025$		
H_0 is not rejected		
smb is statistically insignificant		

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

Based on (a), (b) and (c), I compare the adjusted R^2 of specific excess return on mutual fund with different models ex, comparing btw CAPM1, FFI and CARHART1 because we have to compare with the same dependent variable. And I found that each dependent variables suit with different models. Therefore, we should choose the model which is appropriate with each mutual funds. For example, Iron mutual fund #1, Cashast four-factor model is the most appropriated one because it has the highest adjusted R^2 .