Capital Asset Pricing Model (CAPM)

CAPM: $r_{jt} = \alpha_j + \beta_{j1} r_{mt} + \varepsilon_{jt}$

```
. reg rj rm
```

Source	SS	df	MS	Number of obs	=	11,959
				F(1, 11957)	=	5988.94
Model	11449.5344	1	11449.5344	Prob > F	=	0.0000
Residual	22859.1346	11,957	1.91177842	R-squared	=	0.3337
				Adj R-squared	=	0.3337
Total	34308.669	11,958	2.86909759	Root MSE	=	1.3827

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	.9947206	.0128536	77.39	0.000	.9695254	1.019916
_cons	.0084273	.0126552	0.67	0.505	-.0163789	.0332335

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

```
. reg rj rm smb hml
```

Source	SS	df	MS	Number of obs	=	11,959
				F(3, 11955)	=	2057.22
Model	11681.1999	3	3893.73328	Prob > F	=	0.0000
Residual	22627.4691	11,955	1.89272013	R-squared	=	0.3405
				Adj R-squared	=	0.3403
Total	34308.669	11,958	2.86909759	Root MSE	=	1.3758

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	1.005554	.0128271	78.39	0.000	.9804104	1.030697
smb	.0371377	.0061189	6.07	0.000	.0251437	.0491318
hml	.0562866	.00609	9.24	0.000	.0443492	.068224
_cons	.0073088	.0125928	0.58	0.562	-.0173752	.0319928

1) There doesn't exist any Jesen Alpha.
In CAPM model, Alpha is insignificant (P-Value = 0.505).
In Famen & French model, Alpha is also insignificant (P-Value = 0.827)

2) To determine if portfolio f has the same risk as the market we should perform t-test. My hypothesis is $H_0: \beta_1 = 1$

In CAPM, Portfolio J has the same risk as Market risk since, we failed to reject $\beta_1 = 1$ (P-Value is 0.6813)

```
. . test rm=1

 ( 1)  rm = 1

       F(  1, 11957) =    0.17
            Prob > F =    0.6813
```

In FF, Portfolio J has the same risk as Market risk since, we failed to reject $\beta_1 = 1$ (P-Value is 0.6651)

```
. test rm = 1

 ( 1)  rm = 1

       F(  1, 11955) =    0.19
            Prob > F =    0.6651
```

3) From the Regression result of FF Model above, we could interpreted that size premium is significant since we reject β_{smb} which has p-value of 0.000

4) From the Regression result of FF Model above, we could interpreted that growth premium is significant since we reject β_{hml} which has p-value of 0.000

5) To test whether CAPM or FF model is more appropriated or should we eliminate SMB and HML. We could test our hypotheses $H_0: \beta_{SMB} = \beta_{HML} = 0$.

We reject H_0, Thus β_{SMB} and β_{HML} have significant impact on the model.

```
. test smb hml

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

       F(  2, 11955) =   61.20
            Prob > F =    0.0000
```

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

```
. reg rj rm smb hml d1
```

Source	SS	df	MS	Number of obs	=	11,959
				F(4, 11954)	=	1543.31
Model	11683.8263	4	2920.95657	Prob > F	=	0.0000
Residual	22624.8427	11,954	1.89265875	R-squared	=	0.3406
				Adj R-squared	=	0.3403
Total	34308.669	11,958	2.86909759	Root MSE	=	1.3757

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	1.005405	.0128275	78.38	0.000	.9802607	1.030549
smb	.0369291	.0061214	6.03	0.000	.0249302	.048928
hml	.0562495	.00609	9.24	0.000	.0443121	.0681868
d1	.05393	.045781	1.18	0.239	-.0358082	.1436682
_cons	.0028773	.0131425	0.22	0.827	-.0228842	.0286388

.

6) From the model, The effect on January is denoted by d1 which has a P-value of 0.239 Thus, It is insignificant.

7) From the model, We could see that excess return on Market portfolio at time t, size premium and value premium have positive relationship with the return from portfolio J The overall F-test has P-value less than 0. Thus, This suggest that Rm, SMB, HML is enough to explain explanatory variable. According to R^2, This model could explain dependent variable by 34.06% For individual test, rm, smb and hml are considered significant since P-value is 0.000 but d1 which is dummy variable about January effect is considered insignificant. Thus, January effect might not happend in this case (P-Value is 0.239 which is greater than 0.05).

8)

Chow Test.

(1)

```
. reg rj rm smb hml
```

Source	SS	df	MS	Number of obs	=	11,959
				F(3, 11955)	=	2057.22
Model	11681.1999	3	3893.73328	Prob > F	=	0.0000
Residual	22627.4691	11,955	1.89272013	R-squared	=	0.3405
				Adj R-squared	=	0.3403
Total	34308.669	11,958	2.86909759	Root MSE	=	1.3758

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	1.005554	.0128271	78.39	0.000	.9804104	1.030697
smb	.0371377	.0061189	6.07	0.000	.0251437	.0491318
hml	.0562866	.00609	9.24	0.000	.0443492	.068224
_cons	.0073088	.0125928	0.58	0.562	-.0173752	.0319928

```
. sca rss1=e(rss)

. sca n1=e(N)
```

(2)

```
. reg rj rm smb hml if d1== 0
```

Source	SS	df	MS	Number of obs	=	10,974
				F(3, 10970)	=	1887.21
Model	10805.6192	3	3601.87308	Prob > F	=	0.0000
Residual	20936.975	10,970	1.90856654	R-squared	=	0.3404
				Adj R-squared	=	0.3402
Total	31742.5942	10,973	2.89279087	Root MSE	=	1.3815

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	1.008159	.0134224	75.11	0.000	.9818484	1.034469
smb	.0364768	.0064347	5.67	0.000	.0238636	.04909
hml	.0553364	.0063956	8.65	0.000	.0427998	.0678729
_cons	.0027652	.0131985	0.21	0.834	-.0231062	.0286367

```
. sca rss2=e(rss)

. sca n2=e(N)
```

(3)

```
. reg rj rm smb hml if d1== 1
```

Source	SS	df	MS	Number of obs	=	985
				F(3, 981)	=	169.11
Model	872.032797	3	290.677599	Prob > F	=	0.0000
Residual	1686.17832	981	1.71883621	R-squared	=	0.3409
				Adj R-squared	=	0.3389
Total	2558.21111	984	2.59980804	Root MSE	=	1.311

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	.9725647	.0435176	22.35	0.000	.8871664	1.057963
smb	.0402395	.0198549	2.03	0.043	.0012766	.0792024
hml	.0659675	.0199538	3.31	0.001	.0268104	.1051246
_cons	.0580564	.0421181	1.38	0.168	-.0245956	.1407084

```
. sca rss3=e(rss)

. sca n3=e(N)
```

(4)

```
sca ChowTest =((rss1-rss2-rss3)/4)/((rss2+rss3)/(n2+n3-2*4))

sca list ChowTest
ChowTest =  .56997206
```

According to Chow test, January and other month has the same structure with FF 3mcs, we failed to reject the H_0: $d_1 = 0$ & $smbd_1 = 0$ $hmld_1 = 0$ $rmd_1 = 0$. Therefore FF model and Model (4) should be estimated as 1 model.

F-test

(1)

```
. g hmld1=hml*d1

. reg rj rm smb hml d1 rmd1 smbd1 hmld1
```

Source	SS	df	MS	Number of obs	=	11,959
				F(7, 11951)	=	881.86
Model	11685.5157	7	1669.35938	Prob > F	=	0.0000
Residual	22623.1533	11,951	1.89299249	R-squared	=	0.3406
				Adj R-squared	=	0.3402
Total	34308.669	11,958	2.86909759	Root MSE	=	1.3759

rj	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rm	1.008159	.0133675	75.42	0.000	.9819563	1.034361
smb	.0364768	.0064084	5.69	0.000	.0239153	.0490383
hml	.0553364	.0063695	8.69	0.000	.0428511	.0678216
d1	.0552912	.0461135	1.20	0.231	-.0350988	.1456811
rmd1	-.035594	.0475853	-0.75	0.454	-.1288689	.0576808
smbd1	.0037628	.0217997	0.17	0.863	-.0389682	.0464937
hmld1	.0106311	.0218876	0.49	0.627	-.0322721	.0535344
_cons	.0027652	.0131445	0.21	0.833	-.0230002	.0285307

(2)

```
. test d1 smbd1 hmld1 rmd1

 ( 1)  d1 = 0
 ( 2)  smbd1 = 0
 ( 3)  hmld1 = 0
 ( 4)  rmd1 = 0

       F(  4, 11951) =    0.57
            Prob > F =    0.6844
```

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