

CAPM

```
. regress rj rm
```

Source	SS	df	MS	Number of obs	=	11,959
Model	11449.5344	1	11449.5344	F(1, 11957)	=	5988.94
Residual	22859.1346	11,957	1.91177842	Prob > F	=	0.0000
				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 (FF) Model

```
. regress rj rm smb hml
```

Source	SS	df	MS	Number of obs	=	11,959
Model	11681.1999	3	3893.73328	F(3, 11955)	=	2057.22
Residual	22627.4691	11,955	1.89272013	Prob > F	=	0.0000
				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. According to CAPM, Jensen Alpha is insignificant as p-value (0.505) is greater than 0.05. Thus, null hypothesis (H_0 : Jensen Alpha = 0) cannot be rejected, Jensen Alpha is equal to zero. Similarly, based on FF model, Jensen Alpha is insignificant as p-value (0.562) is greater than 0.05. So, H_0 : Jensen Alpha = 0 cannot be rejected, Jensen Alpha is then equal to zero.

CAPM

```
. test rm==1

( 1)  rm = 1

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

FF Model

```
. test rm==1

( 1)  rm = 1

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

2. Based on CAPM, Portfolio J has the same risk as the market. Since p-value (0.6813) is greater than 0.05, the null hypothesis ($H_0: \beta_j = 1$) cannot be rejected. Therefore, β_j is equal to 1. Also, Portfolio J has the same risk as the market in FF model as p-value (0.6651) is greater than 0.05. Thus, null hypothesis cannot be rejected.
3. Based on FF model, there exists significant size premium as p-value (0) is less than 0.05. The null hypothesis ($H_0: \text{smb}=0$) can be rejected. So, smb is not equal to zero.
4. Based on FF model, there exists significant growth (value) premium as p-value (0) is less than 0.05. The null hypothesis ($H_0: \text{hml}=0$) can be rejected. So, hml is not equal to zero.

```
. test smb hml

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

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

5. FF model is more appropriate because smb (size premium) and hml (value premium) are significant that can explain the model better. Whereas CAPM includes only one variable (market risk premium) that could lead to more bias as many variables are omitted.

```
. regress rj rm smb hml d1
```

Source	SS	df	MS	Number of obs	=	11,959
Model	11683.8263	4	2920.95657	F(4, 11954)	=	1543.31
Residual	22624.8427	11,954	1.89265875	Prob > F	=	0.0000
				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. January effect is insignificant as p-value (0.239) is greater than zero. The null hypothesis ($H_0: d1=0$) cannot be rejected. Therefore, d1 is equal to zero.

7. Sign:

Rm = 1.005405

Smb = 0.0369291

Hml = 0.0562495

D1 = 0.05393

Jensen Alpha = 0.0028773

Overall test: The model is significant as F-test (0) is less than 0.05. Therefore, the null hypothesis can be rejected.

R-square: the model can explain 34.06% of total observations.

Individual test:

Rm smb and hml are significant as p-value (0) is less than 0.05. Therefore, these regressors are not equal to zero. While d1 and Jensen Alpha are insignificant as p-value (0.239 and 0.827 respectively) are greater than 0.05. Thus, null hypothesis cannot be rejected. D1 and Jensen alpha are equal to zero.

```

. g drm=d1*rm

. g dsmb=d1*smb

. g dhml=d1*hml

. reg rj rm drm smb dsmb hml dhml d1

```

Source	SS	df	MS	Number of obs	=	11,959
Model	11685.5157	7	1669.35938	F(7, 11951)	=	881.86
Residual	22623.1533	11,951	1.89299249	Prob > F	=	0.0000
				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
drm	-.035594	.0475853	-0.75	0.454	-.1288689	.0576808
smb	.0364768	.0064084	5.69	0.000	.0239153	.0490383
dsmb	.0037628	.0217997	0.17	0.863	-.0389682	.0464937
hml	.0553364	.0063695	8.69	0.000	.0428511	.0678216
dhml	.0106311	.0218876	0.49	0.627	-.0322721	.0535344
d1	.0552912	.0461135	1.20	0.231	-.0350988	.1456811
_cons	.0027652	.0131445	0.21	0.833	-.0230002	.0285307

```

. test drm dsmb dhml d1

```

```

( 1)  drm = 0
( 2)  dsmb = 0
( 3)  dhml = 0
( 4)  d1 = 0

```

```

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

```

Based on Chow-test, January and other months share the same structure of the FF model. As d1 is insignificant, there is no January effect. So, the models of January and other months should be the same model.