University of California, Los Angeles
Department of Statistics

Statistics C183/C283 **Instructor: Nicolas Christou**

Homework 3

EXERCISE 1
Prove equation (2) for the prediction sum of squares (PRESS) in the paper "The Adjustment of Beta Forecasts", by Robert C. Klemkosky and John D. Martin, *The Journal of Finance*, Vol. 30, No. 4 (Sep., 1975), handout #30. Compute the three components for the (PRESS) value in project 4.

EXERCISE 2
Answer the following questions:

a. Suppose the single index model holds and the investor has access to the risk free asset. Using data from the market and 20 stocks we have obtained the following: $\bar{R}_m = 0.10, \sigma_m^2 = 0.20, \beta_p = 0.9$, and the average residual risk of these 20 stocks is equal to 0.05. What is the variance of the portfolio of these 20 stocks?

b. For 15 stocks we computed the betas for the periods 2009-13 and 2014-2018. The results are shown below. Note: `beta1` are the betas for the period 2009-13, and `beta2` are the betas for the period 2013-18. The last column are the variances of the betas ($\sigma^2_{\hat{\beta}_i}$) for the period 2014-18.

```
Stock    beta2     beta1 var(betas)
C    2.5513904 1.3007678 0.15441843
KEY  0.6925806 0.6097833 0.09365164
WFC  1.3693579 0.3199561 0.08151656
JPM  1.1405373 1.7509958 0.04390123
HE   0.5642004 0.3998354 0.03604710
EIX  0.7178932 0.8312986 0.01089619
LUV  1.1163844 0.9741340 0.04095247
AMR  1.3936788 4.9807786 0.28777332
AMGN 0.4647108 0.7520735 0.04315126
GILD 0.3950172 0.8265294 0.03191687
HIT  1.1809416 0.7343903 0.05492128
IMO  0.9749884 0.2739596 0.03149144
MRO  1.1796907 0.5272593 0.03534135
HES  1.0657046 0.5036067 0.06206313
YPF  0.8229743 1.2438814 0.06601110
```

You are also given:

```
> cor(beta2, beta1)
  0.2744995
> mean(beta2)
  1.042003
> mean(beta1)
  1.068617
> sd(beta2)
  0.5225564
> sd(beta1)
  1.154281
```

Find the adjusted beta for stock `C` for the period 2019-23 using Blume's technique.

c. Assume that the single index model holds. The characteristics of two stocks A and B are the following:

Stock	$\hat{\alpha}$	$\hat{\beta}$	$\hat{\sigma}^2_\epsilon$
A	0.0082	0.79	0.027
B	0.0099	1.12	0.006

In addition, $\sum_{i=1}^{60}(R_{mt} - \bar{R}m)^2 = 0.13$ and $\sigma_m^2 = 0.0022$
Consider the simple regression of R_A on R_m. Compute the coefficient of determination R^2.

EXERCISE 3

The betas of 30 stocks were obtained using simple regression in two successive periods: `2008-12-31` to `2013-01-31` (period 1) and `2013-02-28` to `2017-03-31` (period 2). There are 49 months in each period. Suppose we use the unadjusted betas in the first period as predictions of the betas in the second period. We can then compute the prediction sum of squares (`PRESS`) to evaluate the performance of these unadjusted betas. The following information is obtained from these data:

$\sum_{i=1}^{30} P_i = 32.44349$	Sum of the betas in period 1.
$\sum_{i=1}^{30} A_i = 32.26206$	Sum of the betas in period 2.
$\sum_{i=1}^{30} P_i^2 = 51.70104$	Sum of the squared betas in period 1.
$\sum_{i=1}^{30} A_i^2 = 48.43207$	Sum of the squared betas in period 2.
$\sum_{i=1}^{30}(A_i - \bar{A})(\hat{A}_i - \bar{A}) = 4.299189.$	$\hat{A}_i$ are the fitted values of the simple regression of A on P.

Find the value of the prediction sum of squares (`PRESS`) using its decomposition presented in the paper "The Adjustment of Beta Forecasts", by Robert C. Klemkosky and John D. Martin, *The Journal of Finance*, Vol. 30, No. 4 (Sep., 1975), handout #30

EXERCISE 4

Show that two random variables X and Y cannot possibly have the following properties: $E(X) = 3, E(Y) = 2, E(X^2) = 10, E(Y^2) = 29$, and $E(XY) = 0$.