Answers to Exam No. 1 on Topics from Chapters 2 through 9

1. $SR_t = RFR_t + a\, MR_t - a\, RFR_t + v_t = RFR_t(1 - a) + a\, MR_t + v_t$

Therefore, $b_1 = 0$, $b_2 = a$, and $b_3 = 1 - a$. The relevant restrictions are $b_1 = 0$ and $b_2 + b_3 = 1$.

2. First regress SR_t against a constant, MR_t, and RFR_t, and save the error sum of squares as *ESSA*. Next generate $Y_t = SR_t - RFR_t$ and $X_t = MR_t - RFR_t$. Then regress Y_t against X_t without a constant term and save the error sum of squares as *ESSB*.

3. Compute $F_c = \dfrac{(ESSB - ESSA)/2}{ESSA/(52-3)}$.

4. Under the null hypothesis, F_c has the F-distribution with 2 d.f. for the numerator and 49 d.f. for the denominator.

5. Look up the F-table and find $F^*_{2,49}$, the point at which the area to the right is 0.05. From the table, we interpolate it to be approximately 3.19. Reject the null hypothesis that $b_1 = 0$ and $b_2 + b_3 = 1$ if $F_c > 3.19$.

6. The transformed model is:

(C) $SR_t - r\, SR_{t-1} = b_1(1 - r) + b_2(MR_t - r\, MR_{t-1}) + b_3(RFR_t - r\, RFR_{t-1}) + e_t$

<u>Step 1</u> Fix the value of r. Then generate $SR^* = SR_t - r\, SR_{t-1}$, $MR^* = MR_t - r\, MR_{t-1}$ and $RFR^* = RFR_t - r\, RFR_{t-1}$.

<u>Step 2</u> Regress SR^* against a constant, MR^*, and RFR^*, and get $\hat{b}_1$, $\hat{b}_2$, and $\hat{b}_3$.

<u>Step 3</u> Vary r at broad steps from -0.99 through + 0.99, say, at steps of length 0.1. Choose the $\hat{r}$ that minimizes ESSC as the starting point of a Cochrane-Orcutt iteration.

<u>Step 4</u> Repeat Step 2 after using this $\hat{r}$ in Step 1 and compute

$$\hat{u}_t = SR_t - \hat{b}_1 - \hat{b}_2 MR_t - \hat{b}_3 RFR_t.$$

<u>Step 5</u> Get new estimate $\hat{r} = \dfrac{\Sigma \hat{u}_t \hat{u}_{t-1}}{\Sigma \hat{u}^2_{t-1}}$.

<u>Step 6</u> Repeat Steps 1, 2, 4, and 5, using new $\hat{r}$ values and iterate $\hat{r}$ from two successive iterations do not change by more than say 0.001.

<u>Step 7</u> Using this final $\hat{r}$ estimate Model C.

7.

Testing

Step 1 Regress SR_t against a constant, MR_t , and RFR_t, and save the error term as $\hat{u}_t$.

Step 2 Regress $\hat{u}_t$ against a constant, $\hat{u}_{t-1}$, $\hat{u}_{t-2}$, $\hat{u}_{t-3}$, $\hat{u}_{t-4}$, MR_t , and RFR_t using observations 5 through 52.

Step 3 Compute LM = 52 R^2, where R^2 is the unadjusted goodness of fit in Step 2.

Step 4 Reject the null hypothesis of no serial correlation if LM > 9.48773, the point on the Chi-square distribution with 4 d.f. with an area of 0.05 to the right of it.

Estimation

Step 1 Regress SR_t against a constant, MR_t , and RFR_t, and save the error term as $\hat{u}_t$.

Step 2 Regress $\hat{u}_t$ against a constant, $\hat{u}_{t-1}$, $\hat{u}_{t-2}$, $\hat{u}_{t-3}$, and $\hat{u}_{t-4}$, using observations 5 through 52. This gives the AR parameters $\hat{r}_1, \hat{r}_2, \hat{r}_3$, and $\hat{r}_4$.

Step 3 Generate the new variables

$$SR^* = SR_t - \hat{r}_1 SR_{t-1} - \hat{r}_2 SR_{t-2} - \hat{r}_3 SR_{t-3} - \hat{r}_4 SR_{t-4}$$
$$MR^* = MR_t - \hat{r}_1 MR_{t-1} - \hat{r}_2 MR_{t-2} - \hat{r}_3 MR_{t-3} - \hat{r}_4 MR_{t-4}$$
$$RFR^* = RFR_t - \hat{r}_1 RFR_{t-1} - \hat{r}_2 RFR_{t-2} - \hat{r}_3 RFR_{t-3} - \hat{r}_4 RFR_{t-4}$$

Step 4 Regress SR^* against a constant, MR^*, and RFR^* , and get $\hat{b}_1$, $\hat{b}_2$, and $\hat{b}_3$. Note That, to get $\hat{b}_1$ you should divide the constant term obtain in Step 4 by $1 - \hat{r}_1 - \hat{r}_2 - \hat{r}_3 - \hat{r}_4$.

Step 5 Compute $\hat{u}_t = SR_t - \hat{b}_1 - \hat{b}_2 MR_t - \hat{b}_3 RFR_t$

Step 6 Go back to Step 2 and iterate until the stopping rule given below applies.

Step 7 Stop when the error sum of squares from Step 4 does not change by more than a pre-specified percent, say 0.01.