Econometric Analysis

Homework 1

Given: October 7, 2008

Due: October 21, 2008

Jin-Lung Lin

1 R Programming: Matrix manipulations

Create three vectors x_1, x_2, x_3 and perform the operation as bellows:

$$x_1 = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{pmatrix}; \quad x_2 = \begin{pmatrix} 1 \\ 4 \\ 9 \\ 16 \\ 25 \end{pmatrix}; \quad x_3 = \begin{pmatrix} 10 \\ 8 \\ 6 \\ 4 \\ 2 \end{pmatrix};$$

1. Create X, a 5 by 3 matrix, by combining x_1, x_2, x_3

$$X = (x_1, x_2, x_3)$$

2. Find the determinant of $X'X$

3. Let $b_1, b_2, \cdots, b_5$ be the row vectors of X. Verify that $X'X = \sum_{i=1}^{5} b_i' b_i$.

4. Instead of a 5 by 3 matrix, create X as a 100 by 3 matrix by combining x_1, x_2, x_3; $x_1 = (1, 2, \cdots, 100)'; x_2 = (1^2, 2^2, \cdots, 100^2)'; x_3 = c(200, 198, \cdots, 2)'$. Compute $X'X$, determinant of $X'X$ and verify the matrix multiplication above.

2 R Programming continued

The file *TWNstock.dat* contains daily return of TAIEX, TSMC, UMC, FPG and ChinaSteel from 2004/01/03 to 2007/05/31. Read in the data (hint: use "read.table") and answer the following questions.

1. How many observations are there for each return?

2. Compute the mean, variance, skewness and kurtosis for each return.

3. Compute the cross correlation for all five variables.

4. For each return, compute the percentage of observations such that $|r - \mu| > 2\sigma$ where μ, σ are respectively the mean and standard of that return.

5. Graph the time series plot for each return, one graph in each page.

6. Graph the histogram of each return and compare it with normal distribution with same mean and variance. (Hint: Use curve(dnorm(x,mean=...),add=T)

3 More R programming

1. Draw 100 random numbers from each of the following distributions. Compute the sample mean, sample variance, and compare them with the true mean and true variance. Finally, draw the histogram of the samples along with the theoretical distribution.

   (a) Binomial distribution with n=100, p=0.1.

   (b) Geometric with p=0.1

   (c) Negative binomial distribution with n=100, r=5, p=0.1.

   (d) Hypergeometric distribution with n=10, N=20,

   (e) Poisson distribution with n=100, $\lambda = 4$.

   (f) Uniform distribution with $\theta_1 = 0, \theta_2 = 1$.

   (g) Normal with $\mu = 10, \sigma^2 = 2$

   (h) Gamma distribution with $\alpha = 1, \beta = 3$

   (i) Chi-square with $\nu = 10$

   (j) Beta distribution with $\alpha = 3, \beta = 5$.

4 Analyzing lottery

The lottery numbers in Taiwan from Jan. 2, 2007 to current date are listed below (in reverse time order). Let $X_1, X_2, X_3, X_4, X_5, X_6$ be the six winning numbers each period and the last number (Z) is the special number determining the second prize. Define the following random variables.

(a) Y1=(X1+X2+X3+x4+x5+X6)/6

(b) Y2 = number of even numbers in (X1,X2,X3,x4,x5,X6,Z)

(c) Y3 = number of (X1,X2,X3,x4,x5,X6,Z) which has single digit (¡10)

(d) Y4 = max (X1,X2,X3,X4,X5,X6)

(e) Y5 = min (X1,X2,X3,X4,X5,X6)

Calculate Y1,Y2,Y3,Y4,Y5 for each period and draw the histogram.

X1	X2	X3	X4	X5	X6	Z
47	37	14	15	25	49	13
35	43	28	49	36	38	47
41	04	22	13	24	26	28
21	14	23	31	20	12	45
33	02	15	46	16	31	40
15	39	49	32	12	24	06
49	39	06	36	48	22	28
13	39	48	25	05	30	36
01	19	45	38	33	13	36
34	48	44	19	27	18	37
02	46	25	39	08	43	13
45	07	28	41	48	30	44
16	26	32	48	12	41	01
48	10	12	07	08	47	38
45	06	26	18	39	42	14
36	34	08	26	18	13	17
44	15	07	31	36	06	29
46	45	44	26	06	27	02
28	38	13	33	43	48	04
26	31	33	10	28	16	44
28	39	35	45	26	44	18
19	44	42	48	23	12	33
27	31	13	49	23	21	19