时间序列分析Lab5 实验报告

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8.1

(a)

读入数据后计算统计量：

```
> apply(da[, 2:7], 2, mean)
      MRK       JNJ        GE        GM         F        VW
0.9665028 1.1699716 0.7209367 0.1243458 0.4489213 0.7245890
> apply(da[, 2:7], 2, sd)
     MRK      JNJ       GE       GM        F       VW
7.041246 6.292118 6.432255 8.533425 9.235702 4.465302
> cov(da[, 2:7])
         MRK       JNJ       GE        GM        F       VW
MRK 49.57914 23.867654 17.92527 10.228013 12.69143 14.29833
JNJ 23.86765 39.590745 17.42600  8.818861 11.85487 14.24747
GE  17.92527 17.426005 41.37391 23.551507 25.22338 20.48991
GM  10.22801  8.818861 23.55151 72.819340 54.19326 20.07358
F   12.69143 11.854873 25.22338 54.193257 85.29819 21.85352
VW  14.29833 14.247467 20.48991 20.073579 21.85352 19.93892
> cor(da[, 2:7])
          MRK       JNJ        GE        GM         F        VW
MRK 1.0000000 0.5387204 0.3957792 0.1702231 0.1951601 0.4547629
JNJ 0.5387204 1.0000000 0.4305640 0.1642451 0.2040000 0.5070957
GE  0.3957792 0.4305640 1.0000000 0.4290739 0.4245903 0.7133883
GM  0.1702231 0.1642451 0.4290739 1.0000000 0.6876255 0.5268058
F   0.1951601 0.2040000 0.4245903 0.6876255 1.0000000 0.5299083
VW  0.4547629 0.5070957 0.7133883 0.5268058 0.5299083 1.0000000
```

(b)

多元Ljung-Box统计量Q(m)计算结果如下：

```
> mq(da[, 2:7], 6)
Ljung-Box Statistics:
       m       Q(m)     df    p-value
[1,]   1.0      87.4    36.0        0
[2,]   2.0     130.6    72.0        0
[3,]   3.0     181.4   108.0        0
[4,]   4.0     223.6   144.0        0
[5,]   5.0     249.3   180.0        0
[6,]   6.0     285.1   216.0        0
```

p-value均显著小于5%，拒绝了序列中没有自相关或交叉相关性的零假设。

(c)

根据（b）中序列显著的相关性，6个收益率序列间存在引导-延迟关系。

代码：

```
# 8.1
require(MTS)
da = read.table("D:/USTC/时间序列分析/data/m-mrk2vw.txt", header = T)
apply(da[, 2:7], 2, mean)
apply(da[, 2:7], 2, sd)
cov(da[, 2:7])
cor(da[, 2:7])
mq(da[, 2:7], 6)
```

8.2

(a)

读入数据，计算月利率变化量序列：

	V1	V2
1	0.12	0.22
2	-0.03	0.06
3	-0.07	-0.18
4	-0.10	0.02
5	-0.08	-0.08

计算 AIC 指标、M(i) 统计量和HQ指标：

```
> VARorder(df, 12)
selected order: aic =  12
selected order: bic =  2
selected order: hq =  6
Summary table:
       p     AIC     BIC      HQ     M(p) p-value
 [1,]  0 -5.2077 -5.2077 -5.2077   0.0000  0.0000
 [2,]  1 -5.4063 -5.3797 -5.3960 139.4274  0.0000
 [3,]  2 -5.4872 -5.4339 -5.4665  61.1911  0.0000
 [4,]  3 -5.5015 -5.4216 -5.4706  17.2246  0.0017
 [5,]  4 -5.5079 -5.4012 -5.4666  11.9080  0.0180
 [6,]  5 -5.5089 -5.3756 -5.4573   8.4070  0.0778
 [7,]  6 -5.5690 -5.4091 -5.5071  46.9210  0.0000
 [8,]  7 -5.5647 -5.3781 -5.4925   4.8552  0.3025
 [9,]  8 -5.5742 -5.3609 -5.4916  13.8174  0.0079
[10,]  9 -5.5676 -5.3276 -5.4747   3.3453  0.5018
[11,] 10 -5.5680 -5.3014 -5.4648   7.8630  0.0967
[12,] 11 -5.5791 -5.2858 -5.4656  14.7165  0.0053
[13,] 12 -5.5942 -5.2743 -5.4704  17.2410  0.0017
```

χ_4^2的1%临界值为13.3，综合考虑三个指标，在简化模型的基础上选取VAR(6)模型。去除不显著的系数后，二元自回归模型如下：

$$\begin{bmatrix} c_{1t} \\ c_{2t} \end{bmatrix} = \begin{bmatrix} 0.33 & 0.329 \\ 0 & 0.421 \end{bmatrix} \begin{bmatrix} c_{1,t-1} \\ c_{2,t-1} \end{bmatrix} + \begin{bmatrix} -0.1597 & -0.227 \\ 0.0566 & -0.313 \end{bmatrix} \begin{bmatrix} c_{1,t-2} \\ c_{2,t-2} \end{bmatrix} + \begin{bmatrix} 0 & 0.137 \\ -0.127 & 0.212 \end{bmatrix} \begin{bmatrix} c_{1,t-3} \\ c_{2,t-3} \end{bmatrix} + \begin{bmatrix} -0.131 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} c_{1,t-4} \\ c_{2,t-4} \end{bmatrix} + \begin{bmatrix} 0.206 & 0 \\ 0.163 & -0.111 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} 0.1398 & 0.0709 \\ 0.0709 & 0.0611 \end{bmatrix}$$

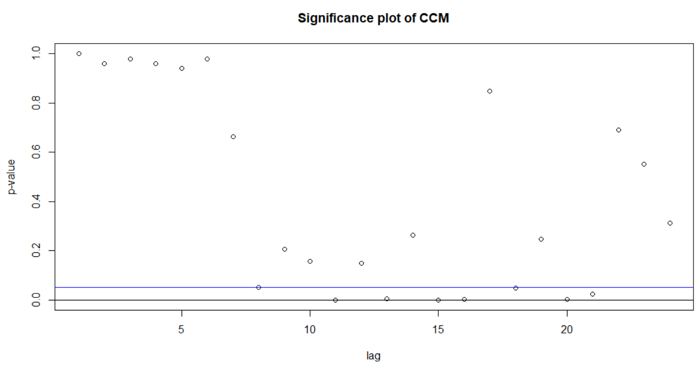
由Cholesky分解：

$$L^{-1} = \begin{bmatrix} 1 & 0 \\ -0.1895 & 1 \end{bmatrix}$$

结构形式为：

$$c_{2t} = 0.1895c_{1t} - 0.06c_{1,t-1} + 0.36c_{2,t-1} + 0.09c_{1,t-2} - 0.27c_{2,t-2} - 0.13c_{1,t-3} + 0.19c_{2,t-3} + 0.02c_{1,t-4} + 0.12c_{1,t-5} - 0.11c_{2,t-5} - 0.14c_{1,t-6}$$

(b)



根据样本互相关矩阵，选取MA(11)模型，简化参数后模型为：

$$\begin{bmatrix} c_{1t} \\ c_{2t} \end{bmatrix} = \begin{bmatrix} a_{1t} \\ a_{2t} \end{bmatrix} + \begin{bmatrix} 0.3614 & 0.301 \\ -0.0048 & 0.445 \end{bmatrix} \begin{bmatrix} a_{1,t-1} \\ a_{2,t-1} \end{bmatrix} + \begin{bmatrix} -0.0545 & -0.0229 \\ -0.0952 & -0.0785 \end{bmatrix} \begin{bmatrix} a_{1,t-3} \\ a_{2,t-3} \end{bmatrix} + \begin{bmatrix} 0.281 & -0.146 \\ -0.241 & -0.169 \end{bmatrix} \begin{bmatrix} a_{1,t-5} \\ a_{2,t-5} \end{bmatrix} + \begin{bmatrix} -0.114 & -0.1048 \\ -0.071 & -0.0406 \end{bmatrix} \begin{bmatrix} a_{1,t-7} \\ a_{2,t-7} \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} 0.1367 & 0.0680 \\ 0.0680 & 0.0591 \end{bmatrix}$$

模型表明两个序列间存在反馈关系。从两个模型的残差协方差矩阵和系数矩阵中可以看出，该模型与二元自回归模型十分相似。

代码：

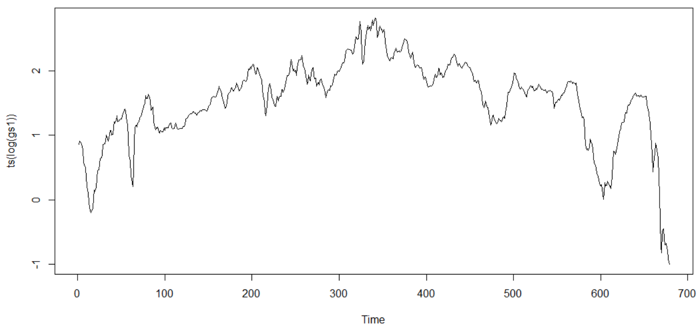
```
require(MTS)
da = read.table("D:/USTC/时间序列分析/data/m-gs1n10.txt", header = T)
attach(da)
df = cbind(diff(gs1), diff(gs10))

VARorder(df, 12)
model = VAR(df, 6)
model = refVAR(model)

chol(model$Sigma)
MTSdiag(model)
VMAorder(df)
model2 = VMAs(df, c(1, 3, 5, 7, 11))
MTSdiag(model2)
```

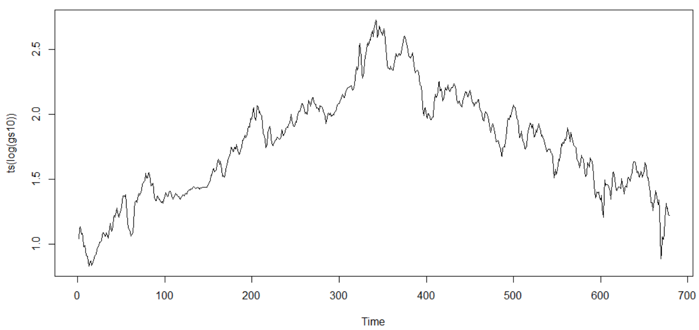
8.3

读入数据，计算对数序列：

	V1	V2
1	0.85866162	1.0402767
2	0.90825856	1.1151416
3	0.89608802	1.1346227
4	0.86710049	1.0750024

观察时序图：





对序列再做差分处理，计算AIC、HQ、M(p)：

```
> VARorder(df, 12)
selected order: aic =  9
selected order: bic =  3
```

```
selected order: hq =  3
Summary table:
        p      AIC      BIC       HQ     M(p) p-value
 [1,]  0 -12.1972 -12.1972 -12.1972   0.0000  0.0000
 [2,]  1 -12.4958 -12.4692 -12.4855 205.6458  0.0000
 [3,]  2 -12.5543 -12.5010 -12.5337  46.4326  0.0000
 [4,]  3 -12.5831 -12.5031 -12.5521  26.6914  0.0000
 [5,]  4 -12.5730 -12.4664 -12.5317   1.1369  0.8884
 [6,]  5 -12.5692 -12.4359 -12.5176   5.2100  0.2664
 [7,]  6 -12.5784 -12.4185 -12.5165  13.7467  0.0081
 [8,]  7 -12.5886 -12.4020 -12.5163  14.2784  0.0065
 [9,]  8 -12.5910 -12.3777 -12.5084   9.2245  0.0557
[10,]  9 -12.6040 -12.3641 -12.5111  16.0410  0.0030
[11,] 10 -12.5952 -12.3286 -12.4920   1.8938  0.7553
[12,] 11 -12.5889 -12.2956 -12.4753   3.5451  0.4711
[13,] 12 -12.5901 -12.2701 -12.4662   8.3164  0.0807
```

选取VAR(9)模型。序列相关主要在lag 1 和 9 处，去除不显著的系数后，模型为：

$$\begin{bmatrix}c_{1t}\\c_{2t}\end{bmatrix}-\begin{bmatrix}0.654 & 0.338\\0.319 & -0.232\end{bmatrix}\begin{bmatrix}c_{1,t-1}\\c_{2,t-1}\end{bmatrix}=\begin{bmatrix}a_{1t}\\a_{2t}\end{bmatrix}+\begin{bmatrix}0.224 & 0.097\\0.298 & -0.545\end{bmatrix}\begin{bmatrix}a_{1,t-1}\\a_{2,t-1}\end{bmatrix}+\begin{bmatrix}0.1529 & 0.415\\0.0466 & 0.237\end{bmatrix}\begin{bmatrix}a_{1,t-2}\\a_{2,t-2}\end{bmatrix}+\begin{bmatrix}0.1052 & -0.1924\\0.0677 & -0.0599\end{bmatrix}\begin{bmatrix}a_{1,t-3}\\a_{2,t-3}\end{bmatrix}+\begin{bmatrix}0.09\\0.09\end{bmatrix}$$

$$\Sigma=\begin{bmatrix}0.0046 & 0.0018\\0.0018 & 0.0014\end{bmatrix}$$

模型表明两个序列间存在反馈关系。

代码：

```r
require(MTS)
da = read.table("D:/USTC/时间序列分析/data/m-gs1n10.txt", header = T)
plot(ts(log(gs1)))
plot(ts(log(gs10)))
attach(da)
df = cbind(diff(log(gs1)), diff(log(gs10)))
VARorder(df, 12)
model = VARMA(df, 1, 9)
refVARMA(model,thres=2)
MTSdiag(model)
```