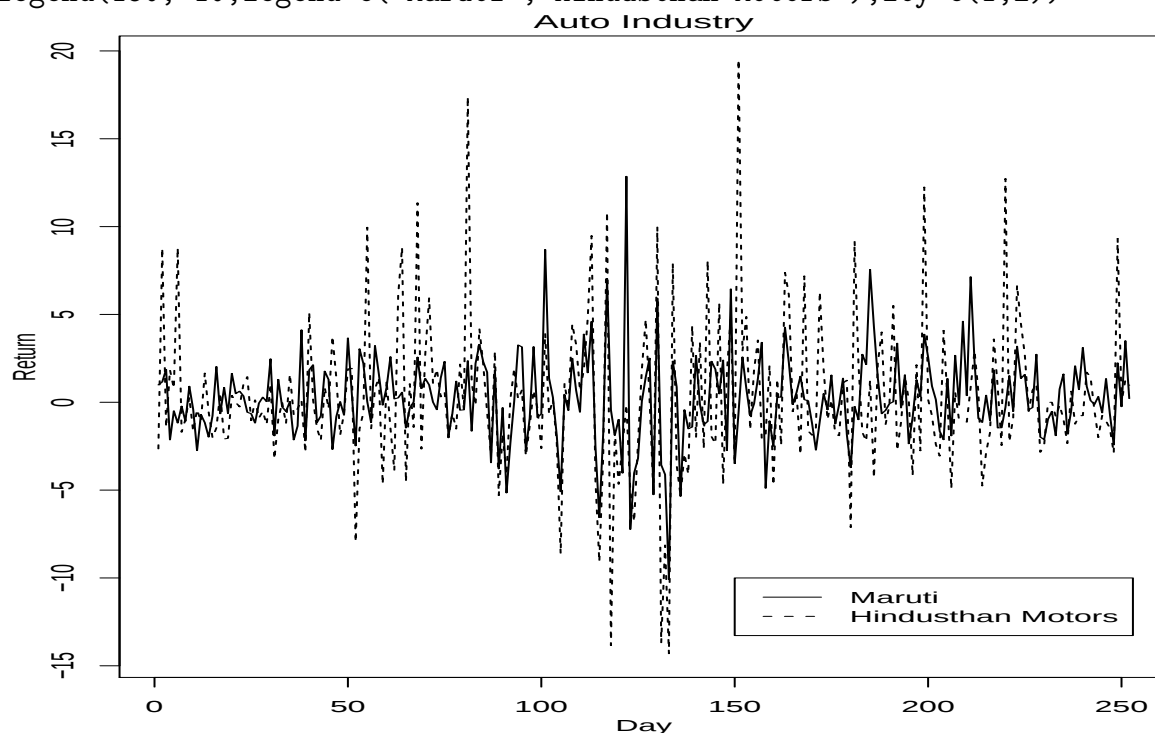


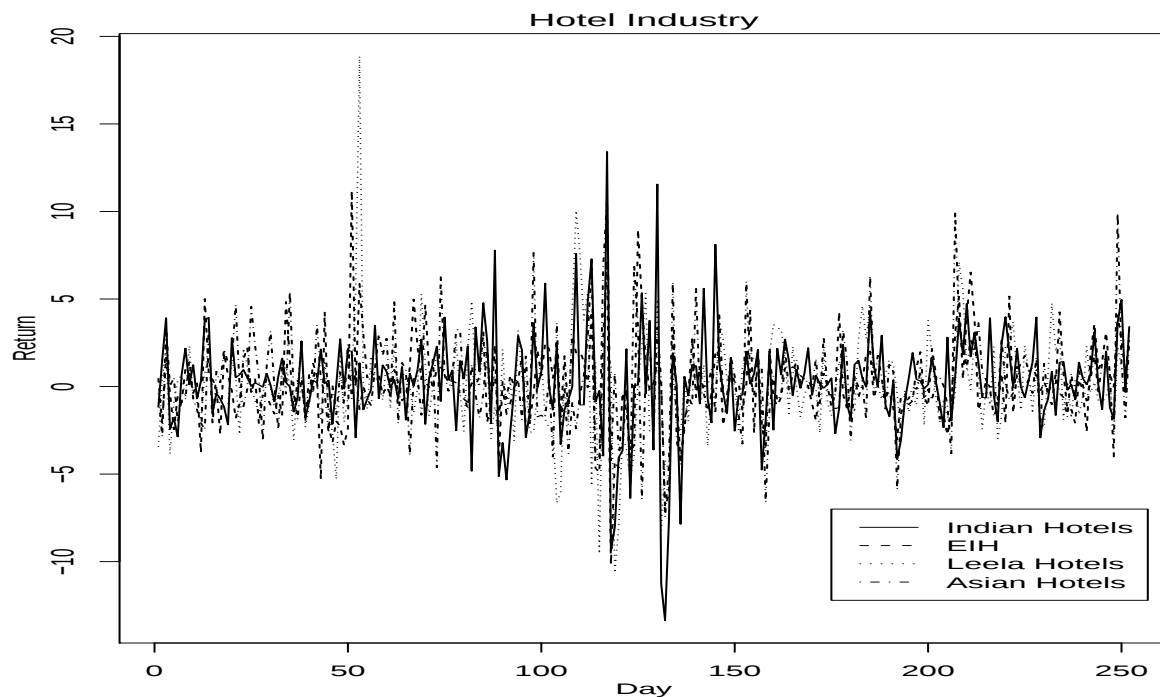
Illustration of Factor Analysis

We wish to Factor Analyse the daily BSE returns of stocks of 17 companies, 2 of them are Auto manufacturers (Maruti Udyog Ltd. and Hindusthan Motors), 4 of them are Hotel chains (Indian Hotels, EIH, Leela Hotels and Asian Hotels), 5 of them are private sector banks (Centurion Banks, Bank of Rajasthan, HDFC, ICICI and Ing Vysya) and 6 of them are from Software industry (Infosys, TCS, Wipro, Satyam Computers, Patni Computers and Iflex Solutions). The returns were considered for the dates 24/11/05 to 23/11/06.

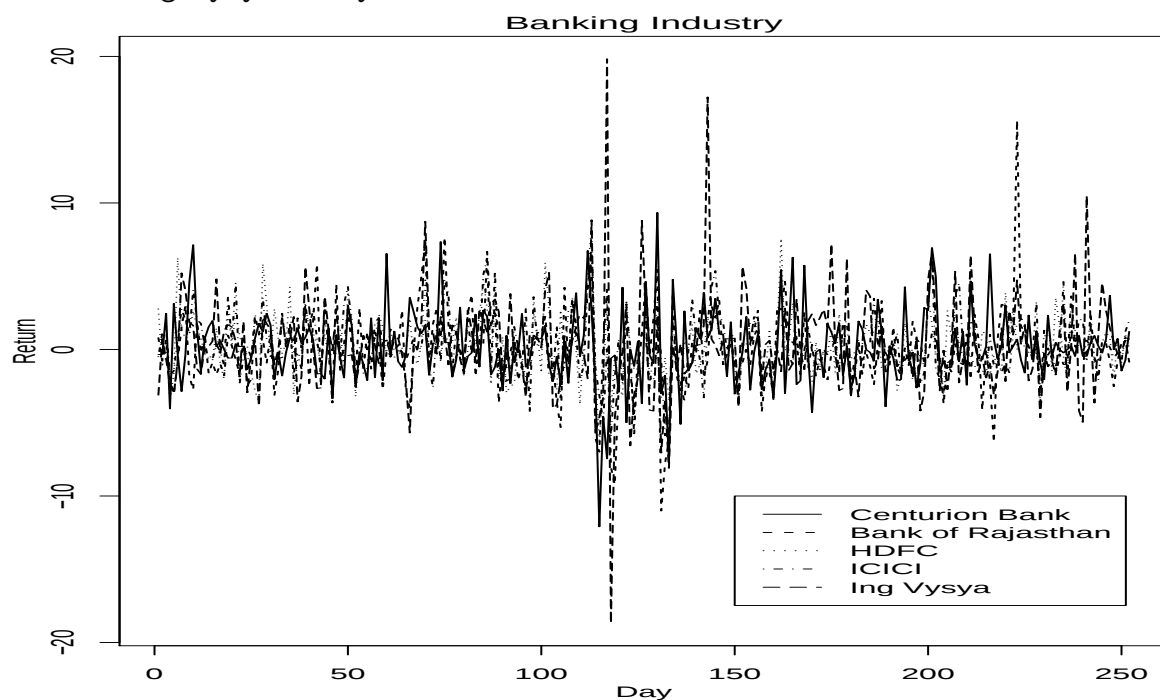
```
> d<-read.table("data",header=T)
> i<-1:252
> plot(c(1,252),range(c(d$Maruti,d$Hindmot)),type="n",xlab="Day",ylab="Return",
      main="Auto Industry")
> lines(i,d$Maruti)
> lines(i,d$Hindmot,lty=2)
> legend(150,-10,legend=c("Maruti","Hindusthan Motors"),lty=c(1,2))
```



```
> plot(c(1,252),range(c(d$IH,d$EIH,d$LH,d$AH)),type="n",xlab="Day",ylab="Return",
      main="Hotel Industry")
> lines(i,d$IH)
> lines(i,d$EIH,lty=2)
> lines(i,d$LH,lty=3)
> lines(i,d$AH,lty=4)
> legend(150,-7,legend=c("Indian Hotels","EIH","Leela Hotels","Asian Hotels"),
      lty=c(1,2,3,4))
```



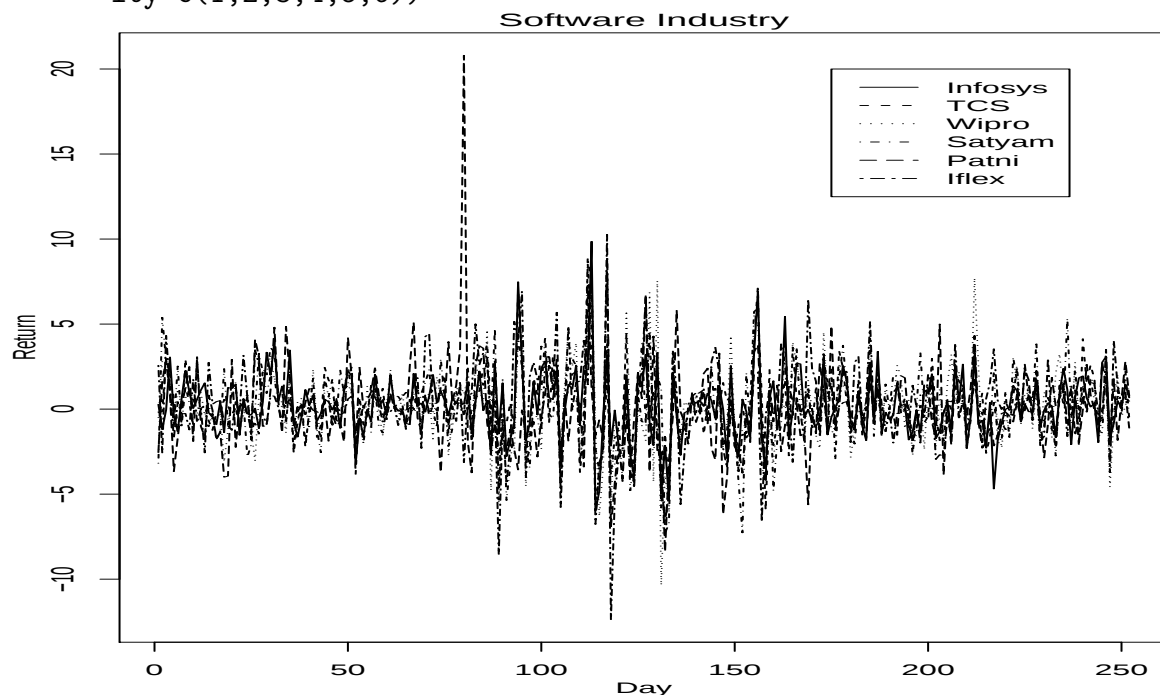
```
> plot(c(1,252),range(c(d$Cent,d$BOR,d$hdfc,d$icici,d$ingv)),type="n",xlab="Day",
      ylab="Return",main="Banking Industry")
> lines(i,d$Cent)
> lines(i,d$BOR,lty=2)
> lines(i,d$hdfc,lty=3)
> lines(i,d$icici,lty=4)
> lines(i,d$ingv,lty=5)
> legend(150,-8,legend=c("Centurion Bank","Bank of Rajasthan","HDFC","ICICI",
      "Ing Vysya"),lty=c(1,2,3,4,5))
```



```

> plot(c(1,252),range(c(d$infy,d$tcs,d$wipro,d$satyam,d$patni,d$iflex)),type="n",
      xlab="Day",ylab="Return",main="Software Industry")
> lines(i,d$infy)
> lines(i,d$tcs,lty=2)
> lines(i,d$wipro,lty=3)
> lines(i,d$satyam,lty=4)
> lines(i,d$patni,lty=5)
> lines(i,d$iflex,lty=6)
> legend(175,20,legend=c("Infosys","TCS","Wipro","Satyam","Patni","Iflex"),
      lty=c(1,2,3,4,5,6))

```



```

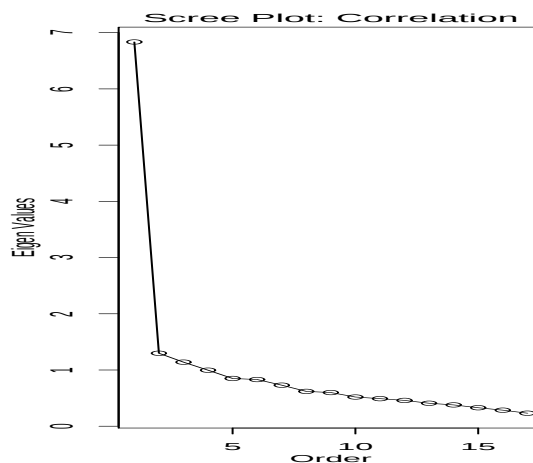
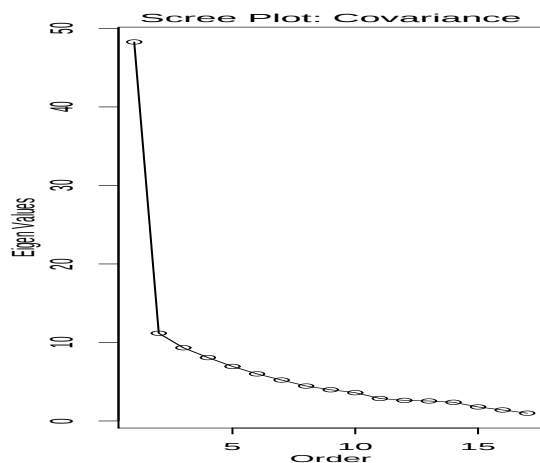
> eigen(cov(d))$values
[1] 48.2722603 11.1738168 9.3275666 8.0769371 6.9459370 5.9991854
[7] 5.2127419 4.4496204 3.9750176 3.6042535 2.8652502 2.6221027
[13] 2.5448764 2.3810055 1.7866578 1.4026865 0.9921965
> cumsum(eigen(cov(d))$values/sum(eigen(cov(d))$values))
[1] 0.3968710 0.4887367 0.5654234 0.6318281 0.6889342 0.7382565 0.7811132
[8] 0.8176958 0.8503764 0.8800089 0.9035656 0.9251232 0.9460459 0.9656214
[15] 0.9803104 0.9918426 1.0000000
> eigen(cor(d))$values
[1] 6.8346388 1.2980109 1.1396901 0.9966844 0.8493063 0.8303034 0.7300771
[8] 0.6196423 0.5989642 0.5193078 0.4904734 0.4591859 0.4087549 0.3789282
[15] 0.3288696 0.2853661 0.2317967
> cumsum(eigen(cor(d))$values/17)
[1] 0.4020376 0.4783912 0.5454317 0.6040602 0.6540194 0.7028608 0.7458065
[8] 0.7822561 0.8174893 0.8480368 0.8768882 0.9038991 0.9279435 0.9502334
[15] 0.9695787 0.9863649 1.0000000
> plot(1:17,eigen(cov(d))$values,type="l",xlab="Order",ylab="Eigen Values",

```

```

    main="Scree Plot: Covariance")
> points(1:17,eigen(cov(d))$values)
> plot(1:17,eigen(cor(d))$values,type="l",xlab="Order",ylab="Eigen Values",
    main="Scree Plot: Correlation")
> points(1:17,eigen(cor(d))$values)

```



```

> factanal(d,1)$PVAL
objective
2.184726e-22
> factanal(d,2)$PVAL
objective
7.911608e-07
> factanal(d,3)$PVAL
objective
0.0002205683
> factanal(d,4)$PVAL
objective
0.01318502
> factanal(d,5)$PVAL
objective
0.1121729

```

```

> factanal(d,5)

```

Uniquenesses:

	Maruti	Hindmot	IH	EIH	LH	AH	Cent	BOR	hdfc	icici
	0.512	0.005	0.423	0.525	0.228	0.768	0.771	0.495	0.576	0.368
	ingv	infy	tcs	wipro	satyam	patni	iflex			
	0.649	0.356	0.223	0.323	0.415	0.781	0.439			

Loadings:

	Factor1	Factor2	Factor3	Factor4	Factor5
Maruti	0.484	0.324	0.253	0.211	0.201

Hindmot	0.219	0.268	0.165	0.917	
IH	0.340	0.554	0.260	0.200	0.217
EIH	0.126	0.597	0.121		0.286
LH	0.109	0.197	0.121		0.840
AH	0.158	0.430	0.104		
Cent	0.150		0.360	0.123	0.243
BOR	0.156	0.369	0.456	0.277	0.245
hdfc	0.336	0.163	0.527		
icici	0.302	0.261	0.687		
ingv	0.126	0.435	0.336	0.182	
infy	0.661	0.361	0.256		
tcs	0.819	0.191	0.229		
wipro	0.735	0.240	0.219	0.143	0.101
satyam	0.627	0.337	0.243	0.104	
patni	0.204	0.411			
iflex	0.340	0.614	0.238	0.104	

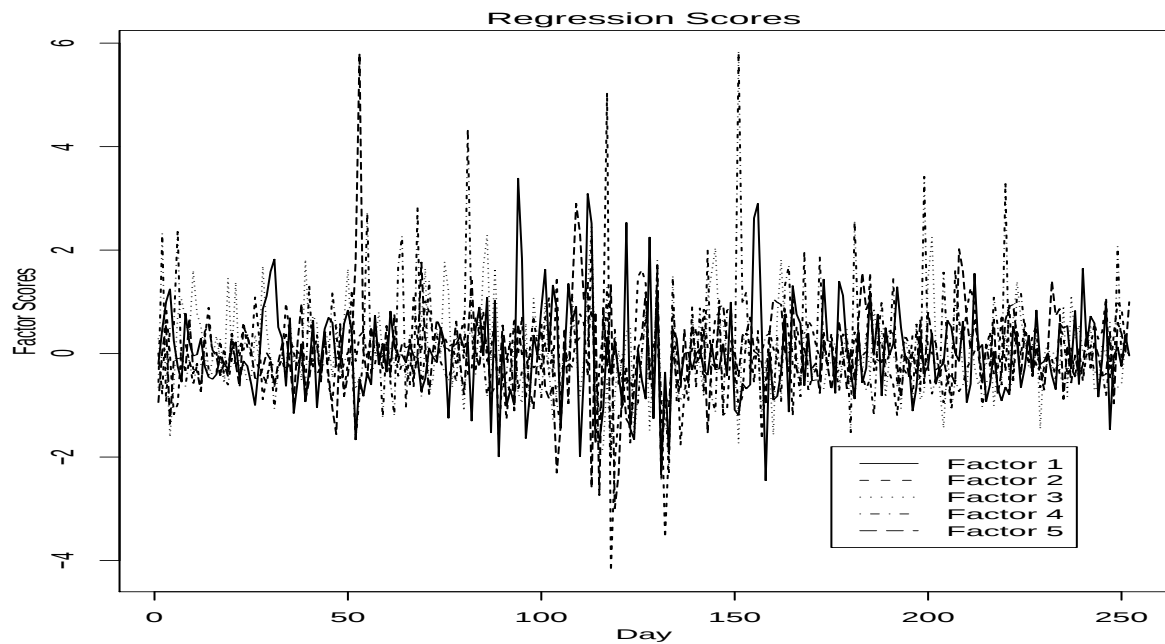
	Factor1	Factor2	Factor3	Factor4	Factor5
SS loadings	2.918	2.372	1.684	1.127	1.042
Proportion Var	0.172	0.140	0.099	0.066	0.061
Cumulative Var	0.172	0.311	0.410	0.476	0.538

Test of the hypothesis that 5 factors are sufficient.
The chi square statistic is 74.67 on 61 degrees of freedom.
The p-value is 0.112

```
> regscores<-factanal(d,5,scores="regression")$scores
> wlsscores<-factanal(d,5,scores="Bartlett")$scores
> regscores
      Factor1      Factor2      Factor3      Factor4      Factor5
1  -0.2037321701  0.009601025  0.285689822 -0.6485596713 -0.944720331
2   0.4654927938 -0.785107272 -0.171815411  2.3226612038  0.046292439
.....
.....
251 0.3640936449  0.207304471  0.238649209  0.0850951929  0.003047621
252 -0.0438980846  0.301295384  0.293434673 -0.0195637742  1.000262839

> plot(c(1,252),range(regscores),type="n",xlab="Day",ylab="Factor Scores",
      main="Regression Scores")
> lines(i,regscores[,1])
> lines(i,regscores[,2],lty=2)
> lines(i,regscores[,3],lty=3)
> lines(i,regscores[,4],lty=4)
> lines(i,regscores[,5],lty=5)
> legend(175,-1.8,legend=c("Factor 1","Factor 2","Factor 3","Factor 4","Factor 5"),
```

```
lty=c(1,2,3,4,5))
```



```
> plot(c(1,252),range(wlsscores),type="n",xlab="Day",ylab="Factor Scores",
      main="WLS Scores")
> lines(i,wlsscores[,1])
> lines(i,wlsscores[,2],lty=2)
> lines(i,wlsscores[,3],lty=3)
> lines(i,wlsscores[,4],lty=4)
> lines(i,wlsscores[,5],lty=5)
> legend(175,-2,legend=c("Factor 1","Factor 2","Factor 3","Factor 4","Factor 5"),
      lty=c(1,2,3,4,5))
```

