# Equity Premium - Exploratory data analysis

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## Initialize

Libraries to use

```
library(ggplot2)
library(lattice)
library(caret)
library(corrplot)
library(car)
library(RColorBrewer)
```

## Import and clean data

- Data from Amit Goyal's equity premium dataset
- http://www.hec.unil.ch/agoyal/
- http://www.hec.unil.ch/agoyal/docs/PredictorData2016.xlsx
- Import data from CSV

```
setwd("C:/Users/druce/R/EquityPremium2017")
data<-read.csv('PredictorData2016q.csv',na.strings = c("NA","#DIV/0!", "","NaN"))
```

## Clean. . . Trim NA valued columns

```
countMissing <- function(mycol) {
  return (sum(is.na(data[, mycol]))/ nrow(data))
}
countNAs <- data.frame(countNA=sapply(colnames(data), countMissing))
countNAs
```

```
##               countNA
## yyyyq      0.00000000
## Index      0.00000000
## D12        0.00000000
## E12        0.00000000
## b.m        0.34246575
## tbl        0.33561644
## AAA        0.32876712
## BAA        0.32876712
## lty        0.32876712
## cay        0.55479452
## ntis       0.38184932
## Rfree      0.00000000
## infl       0.28938356
## ltr        0.37671233
```

```
## corpr      0.37671233
## svar       0.09589041
## csp        0.54965753
## ik         0.52054795
## CRSP_SPvw  0.37671233
## CRSP_SPvwx 0.37671233
## D3         0.80136986
## E3         0.43835616
```

```
subset(countNAs, countNAs$countNA > 0.5)
```

```
##       countNA
## cay 0.5547945
## csp 0.5496575
## ik  0.5205479
## D3  0.8013699
```

```
colsToDeleteNA <- countNAs$countNA > 0.5
data <- data[, !colsToDeleteNA]
```

### Clean. . . Trim NA valued rows

```
rowsToDelete <- data$yyyyq <= 19254
data <- data[!rowsToDelete,]
```

### Add EqPrem column

```
data$EqPrem = data$CRSP_SPvw - data$Rfree
```

### Explore data

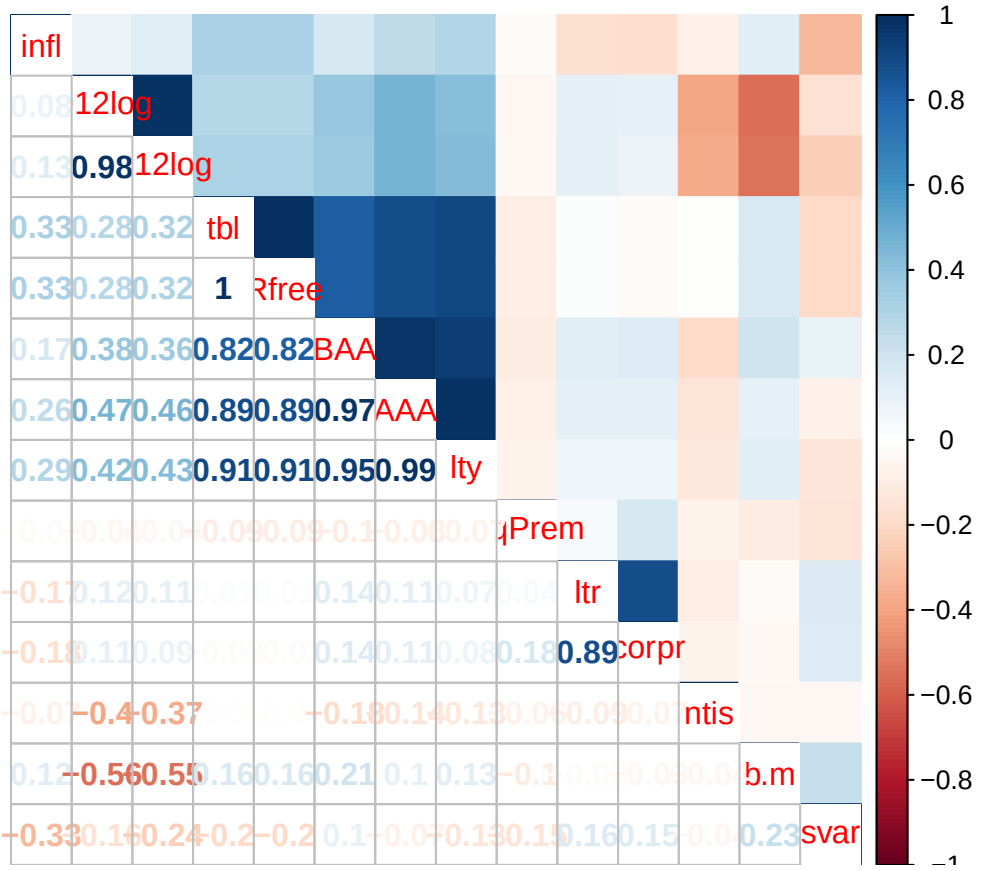
```
nearzero <- nearZeroVar(data, saveMetrics=TRUE)
nearzero
```

```
##           freqRatio percentUnique zeroVar   nzv
## yyyyq          1.00     100.00000   FALSE FALSE
## Index          1.00      98.90110   FALSE FALSE
## D12            1.00      81.59341   FALSE FALSE
## E12            1.00      90.38462   FALSE FALSE
## b.m            1.00     100.00000   FALSE FALSE
## tbl            3.00      71.97802   FALSE FALSE
## AAA            1.25      77.74725   FALSE FALSE
## BAA            1.50      76.64835   FALSE FALSE
## lty            1.00      76.64835   FALSE FALSE
## ntis           1.00      99.17582   FALSE FALSE
## Rfree          3.00      71.97802   FALSE FALSE
## infl           8.75      85.98901   FALSE FALSE
## ltr            1.00     100.00000   FALSE FALSE
## corpr          1.00     100.00000   FALSE FALSE
## svar           1.00     100.00000   FALSE FALSE
## CRSP_SPvw      1.00     100.00000   FALSE FALSE
```

```
## CRSP_SPvwx      1.00      100.00000   FALSE FALSE
## E3              1.20       70.05495   FALSE FALSE
## EqPrem          1.00      100.00000   FALSE FALSE
```

### Correlations of raw data

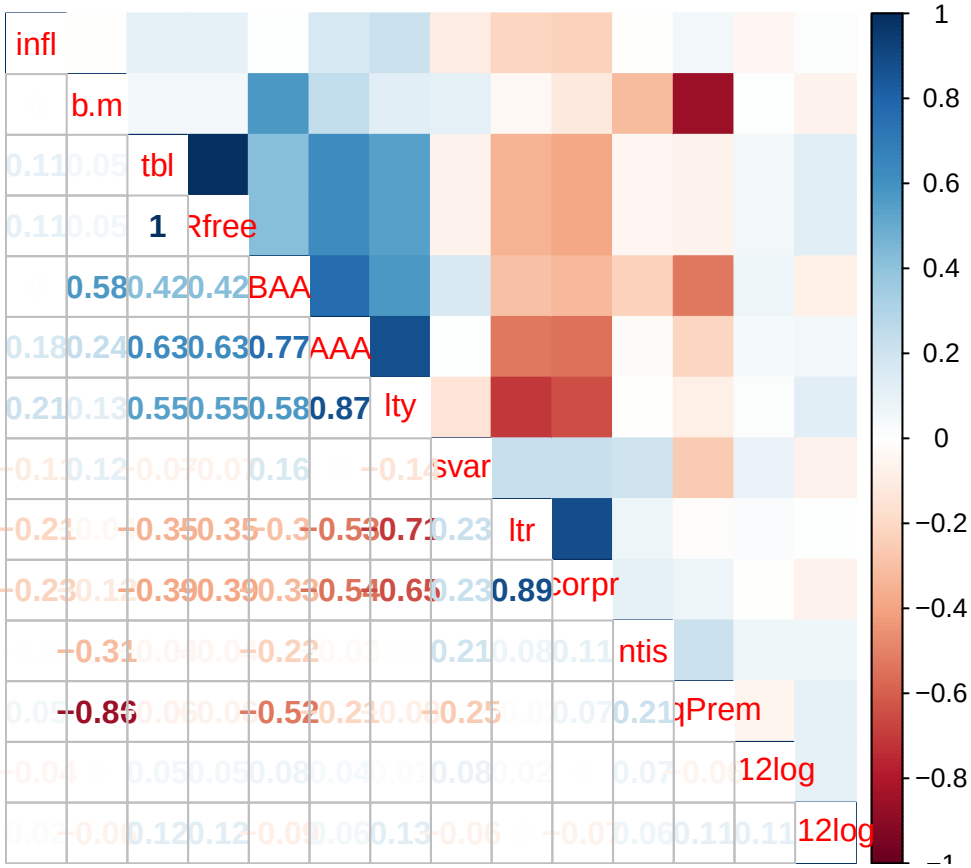
```
corrdata <- data[,c("D12","E12","b.m","tbl","AAA","BAA","lty","ntis","Rfree","infl","ltr","corpr","svar
corrdata <- corrdata[complete.cases(corrdata),]
corrdata$D12log <- log(corrdata$D12)
corrdata$E12log <- log(corrdata$E12)
corrdata <- corrdata[,c("D12log","E12log","b.m","tbl","AAA","BAA","lty","ntis","Rfree","infl","ltr","co
mycor <- cor(corrdata)
corrplot.mixed(mycor, upper="color", order="hclust")
```




### Correlations of first differences (and raw EqPrem)

```
data2 <- data[,c("D12","E12","b.m","tbl","AAA","BAA","lty","ntis","Rfree","infl","ltr","corpr","svar","
data2$D12log <- log(data2$D12)
data2$E12log <- log(data2$E12)
data2 <- data2[,c("D12log","E12log","b.m","tbl","AAA","BAA","lty","ntis","Rfree","infl","ltr","corpr","
diffs <- tail(data2, -1) - head(data2, -1)
diffs$EqPrem <- tail(data$EqPrem, -1)
corrdata <- diffs[,c("D12log","E12log","b.m","tbl","AAA","BAA","lty","ntis","Rfree","infl","ltr","corpr
```

```
corrdata <- corrdata[complete.cases(corrdata),]
mycor <- cor(corrdata)
corrplot.mixed(mycor, upper="color", order="hclust")
```




**We see Rfree is perfectly correlated with tbl so we can remove it from further correlation analysis**

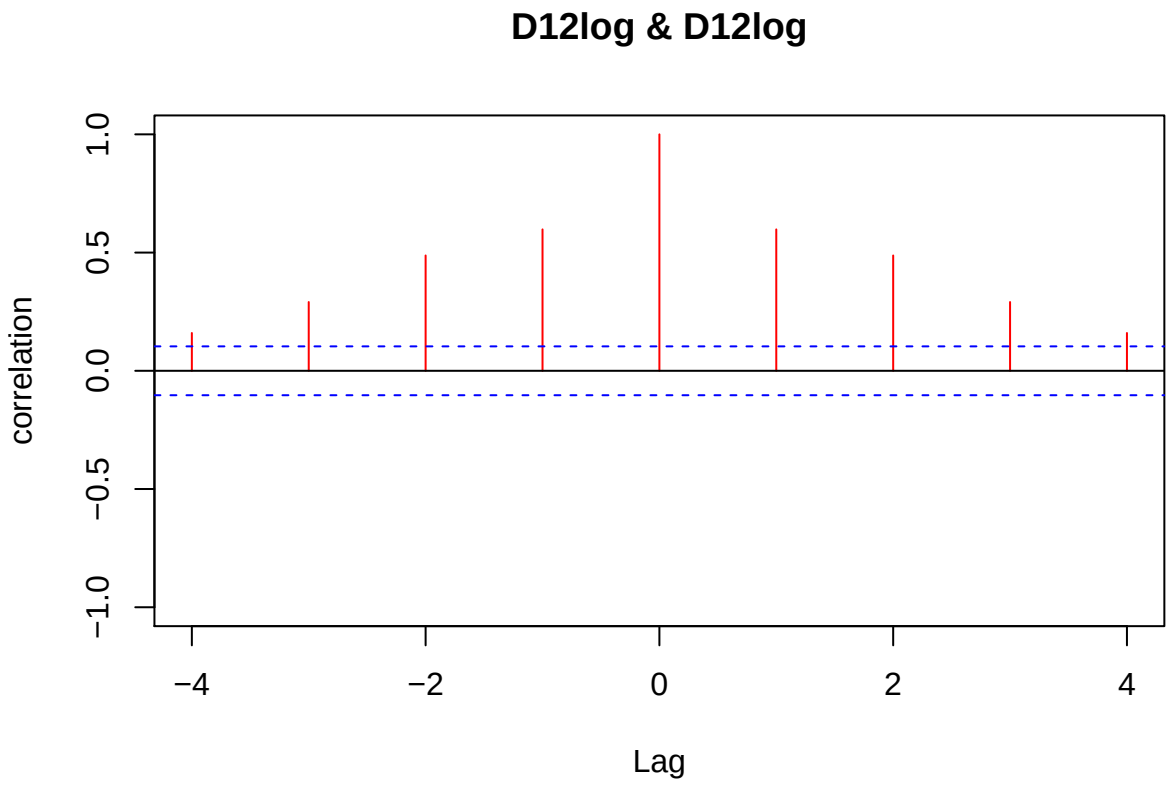
```
corrdata <- corrdata[, !(names(corrdata) %in% c("Rfree"))]
1
```

```
## [1] 1
```

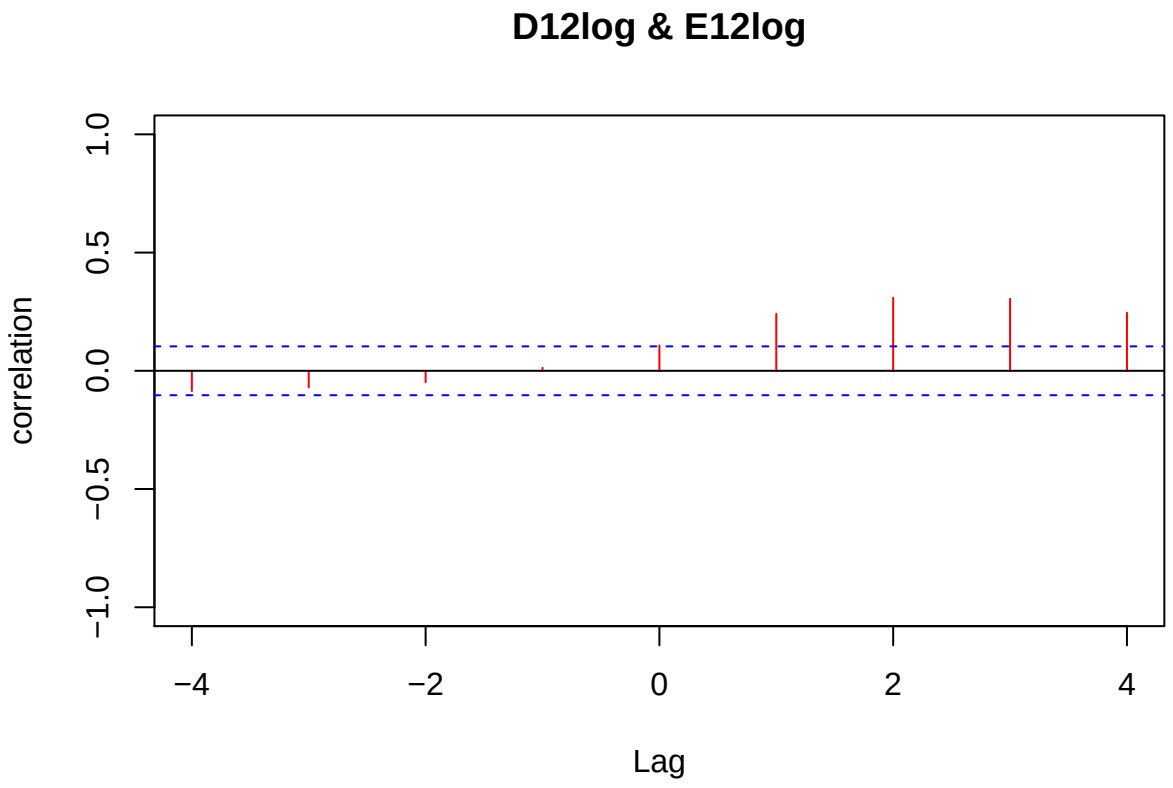
**Look at interesting correlations of a few variables with leads and lags**

- dividends and earnings show significant positive serial correlation (if it's ttm then consecutive quarters share 9 months; but also we expect management to smooth and keep on trend.)
- might have thought EqPrem would have some modest serial correlation, but no
- some of the interest rates show odd patterns, almost wonder if there's an artifact like month-end vs. average

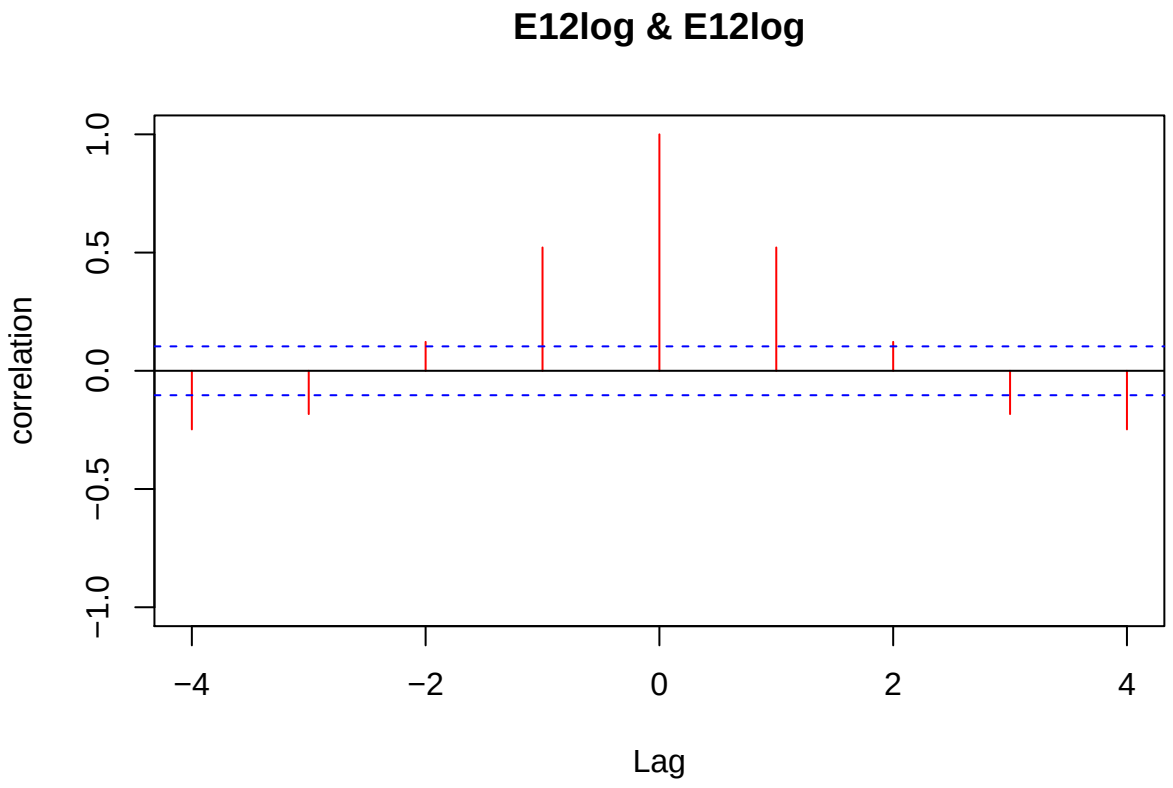
```
attach(corrdata)
ccf(D12log, D12log, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



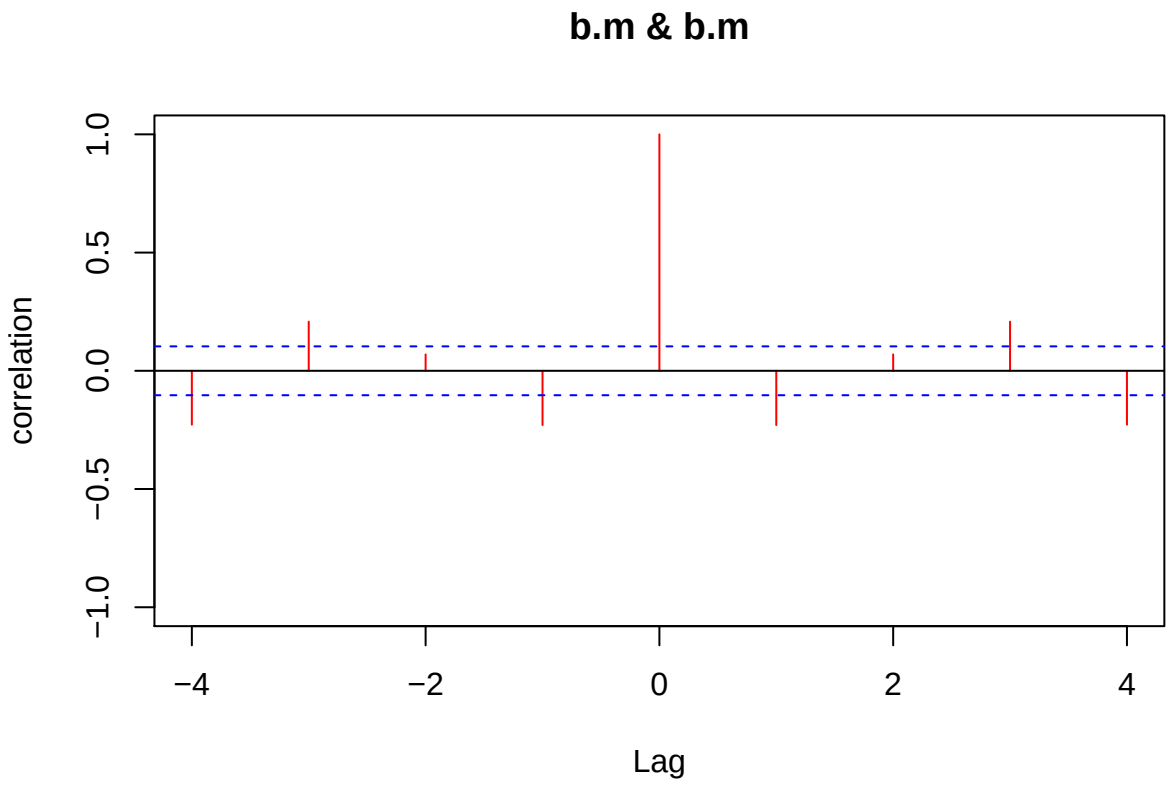

```
ccf(D12log, E12log, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



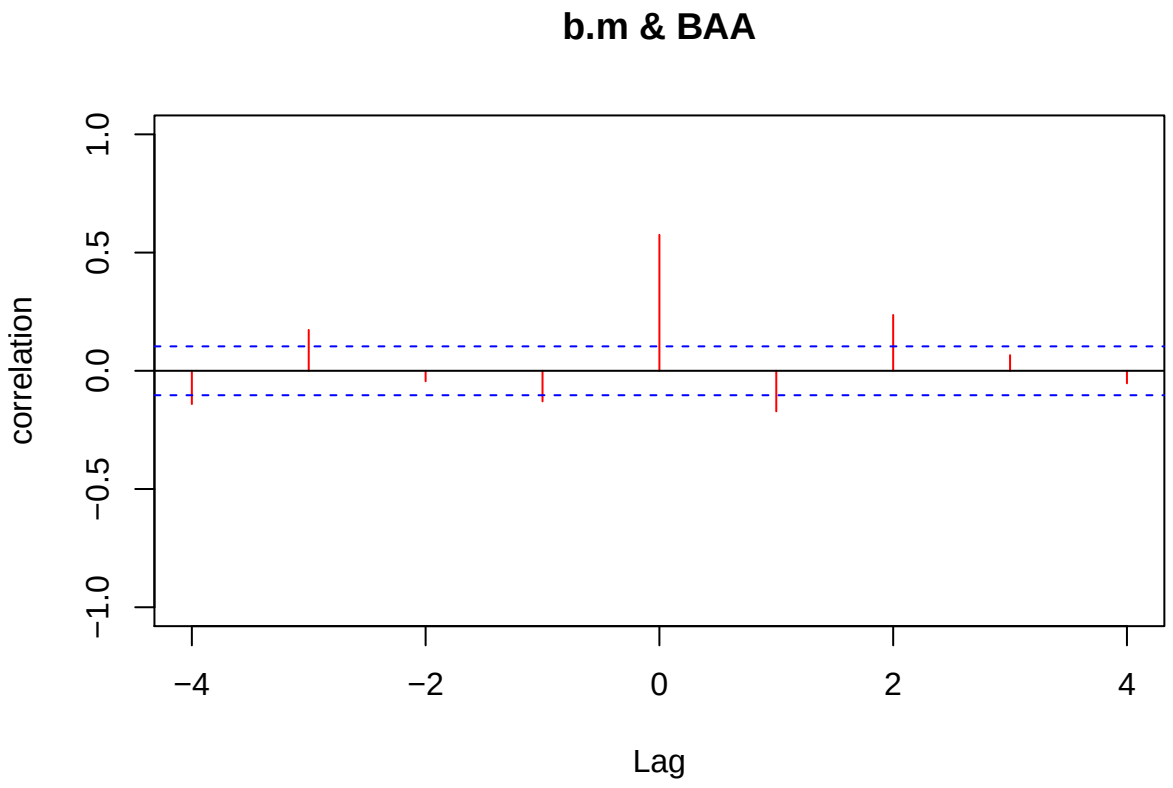

```
ccf(E12log, E12log, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



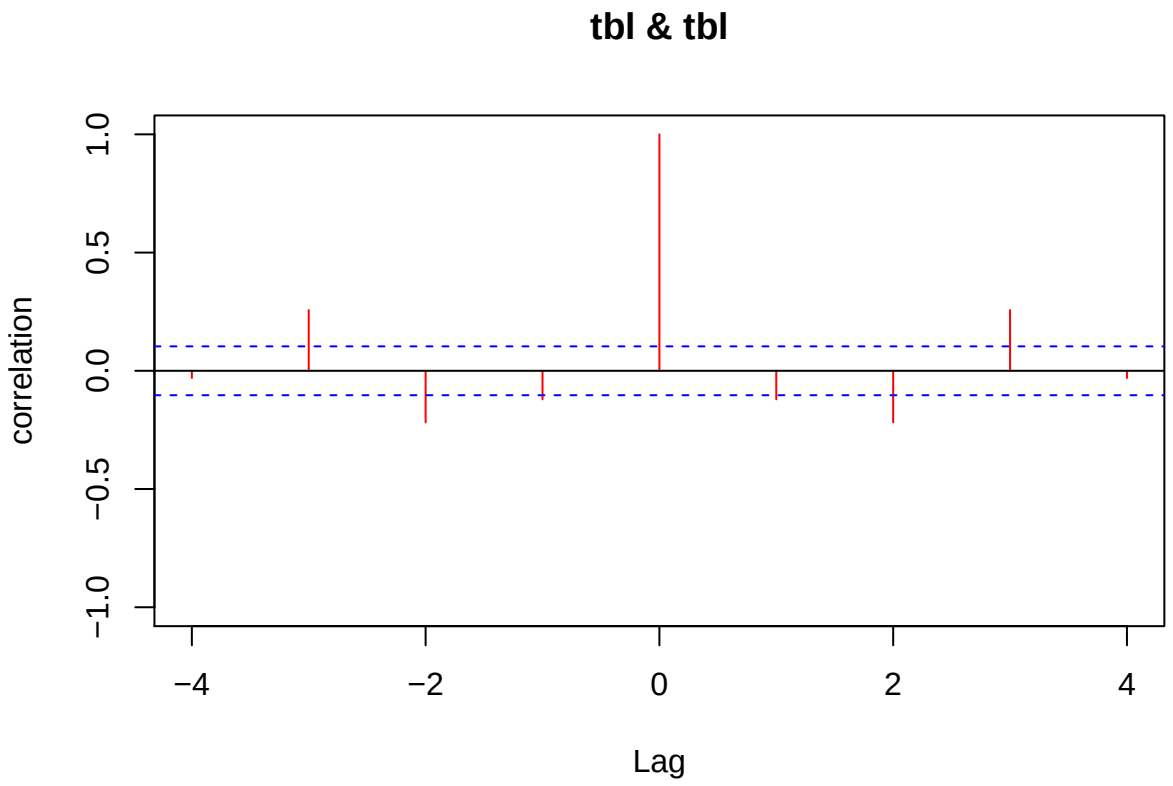

```
ccf(b.m, b.m, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



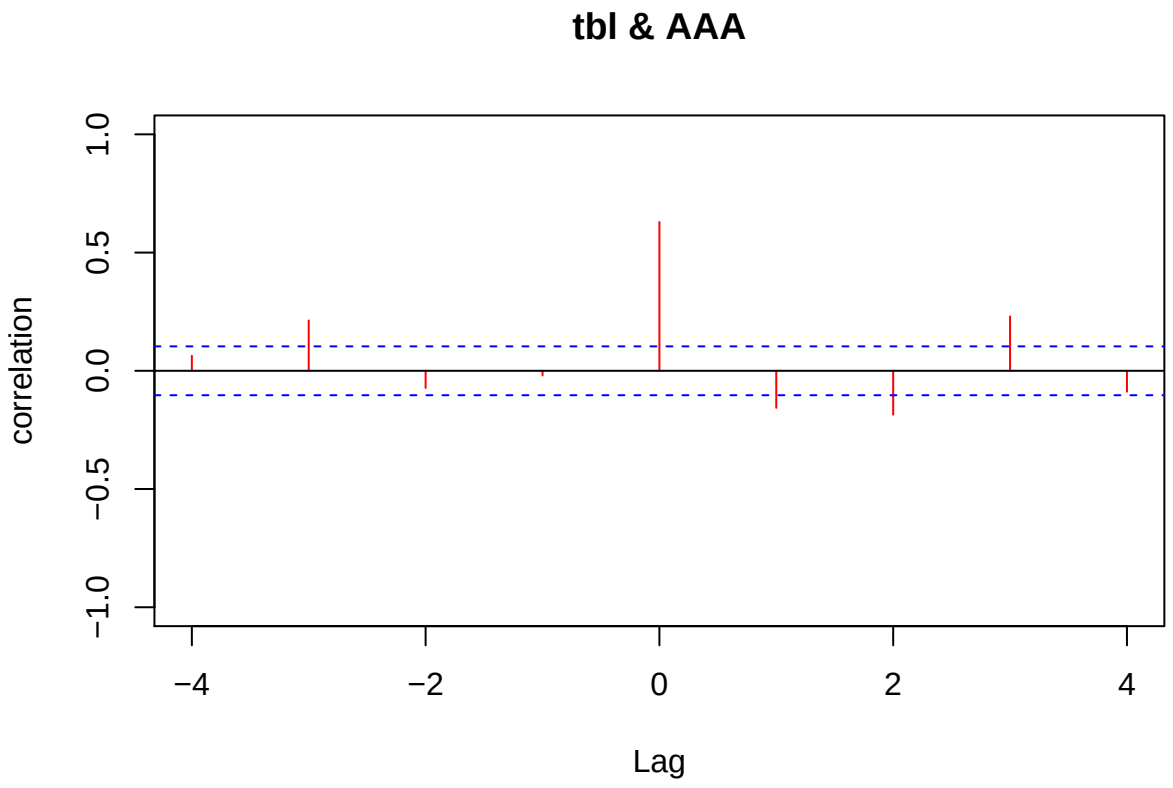

```
ccf(b.m, BAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



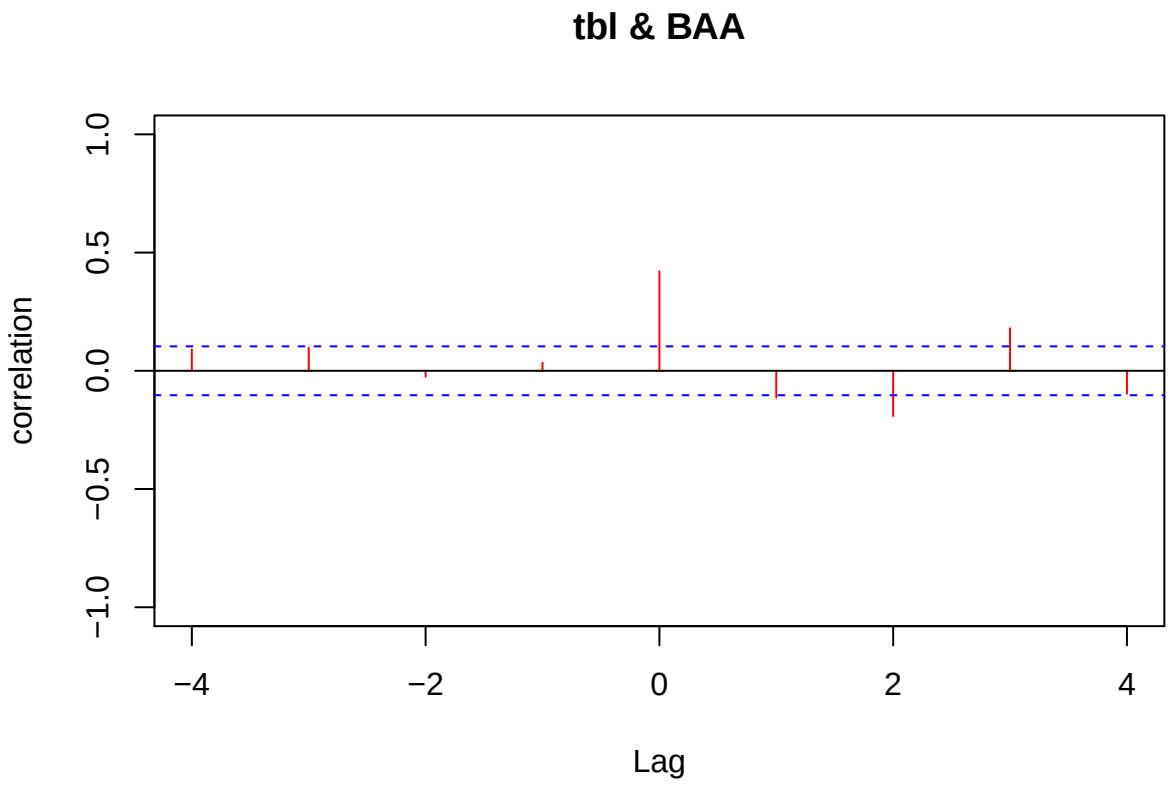

```
ccf(tbl, tbl, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



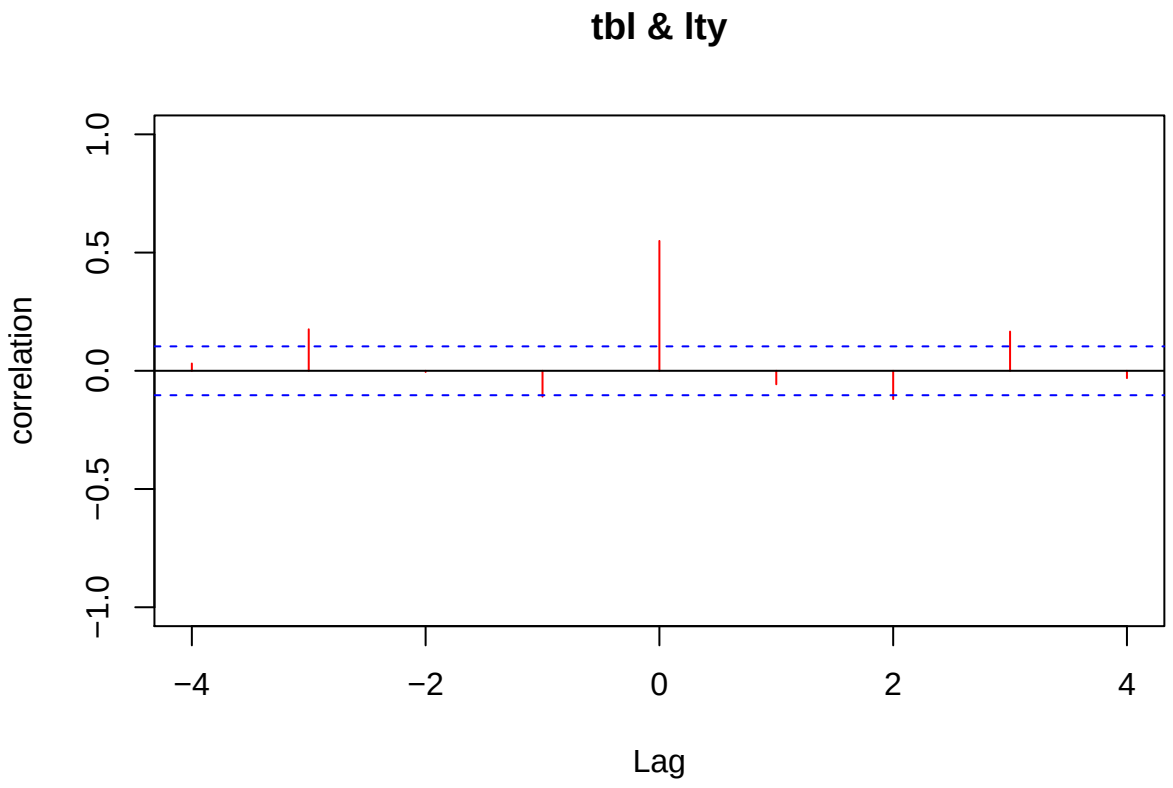

```
ccf(tbl, AAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



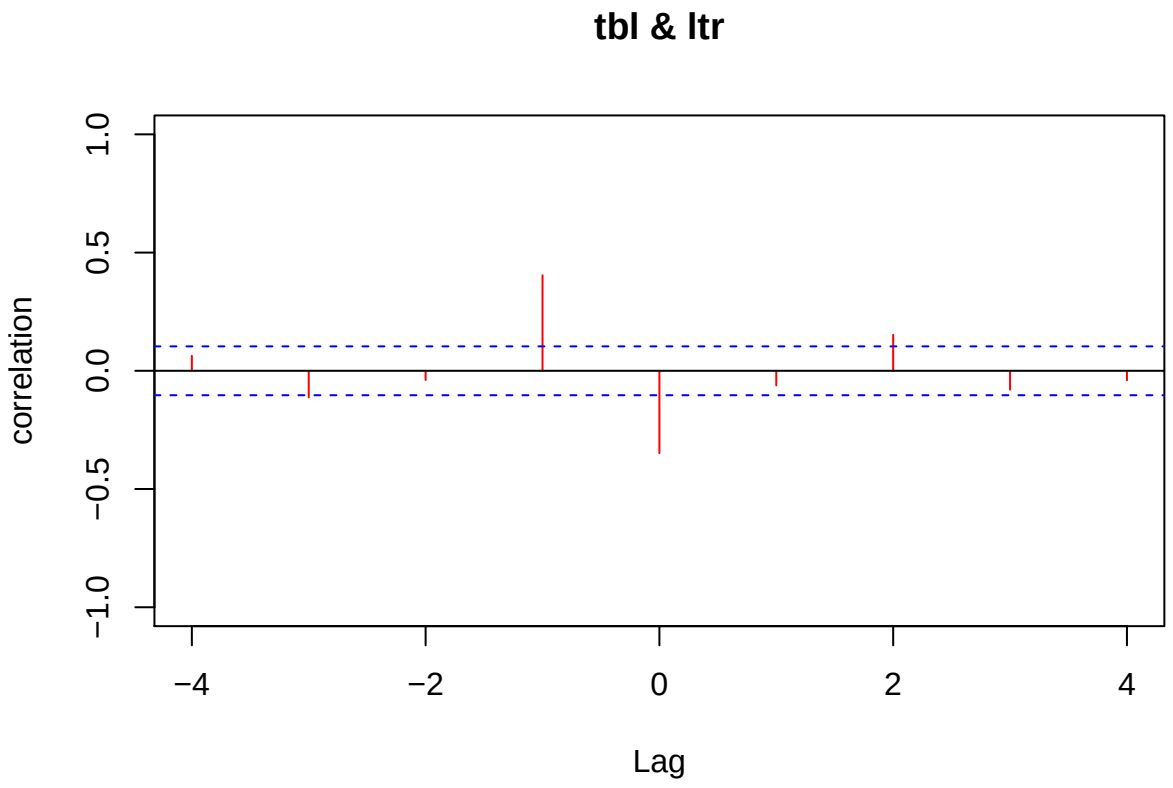

```
ccf(tbl, BAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



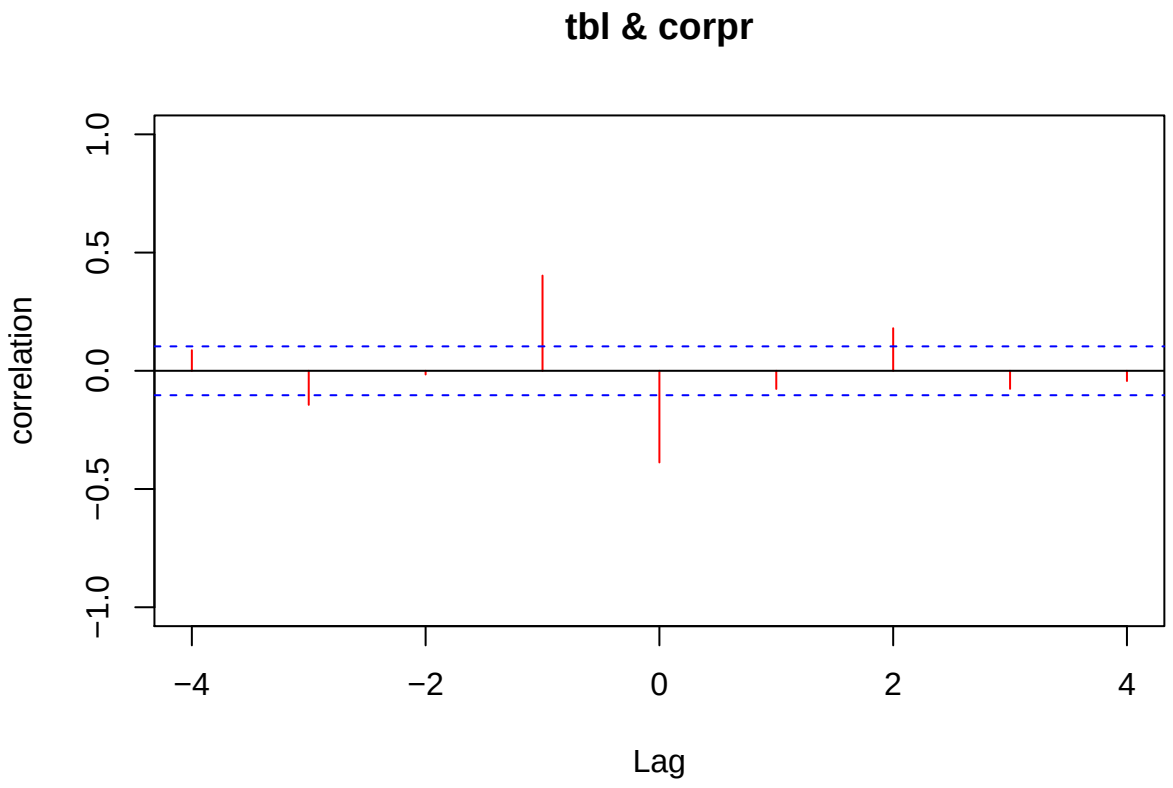

```
ccf(tbl, lty, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



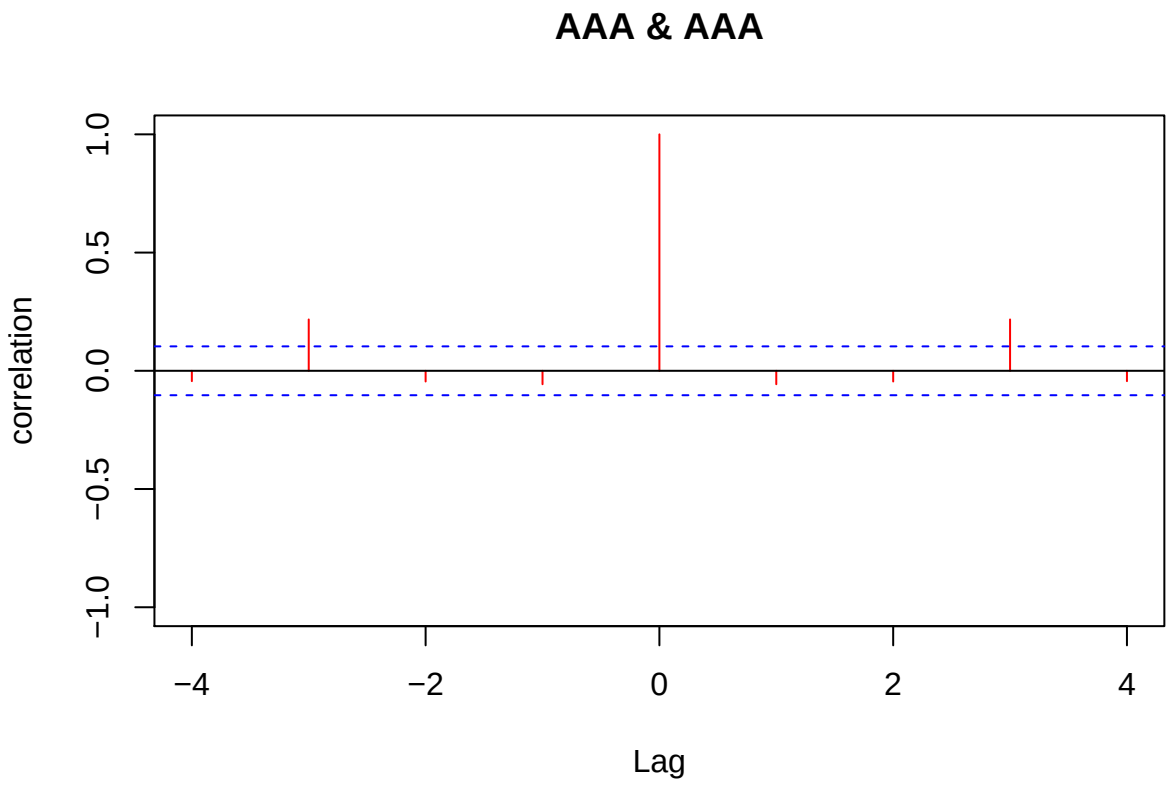

```
ccf(tbl, ltr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



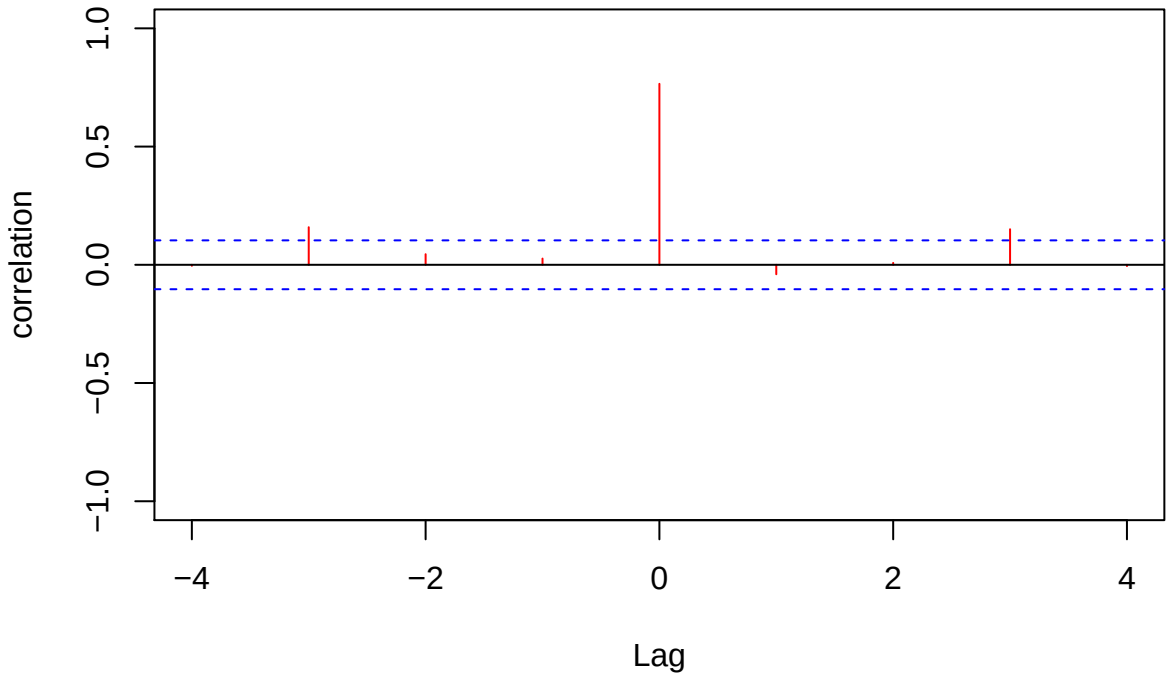

```
ccf(tbl, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



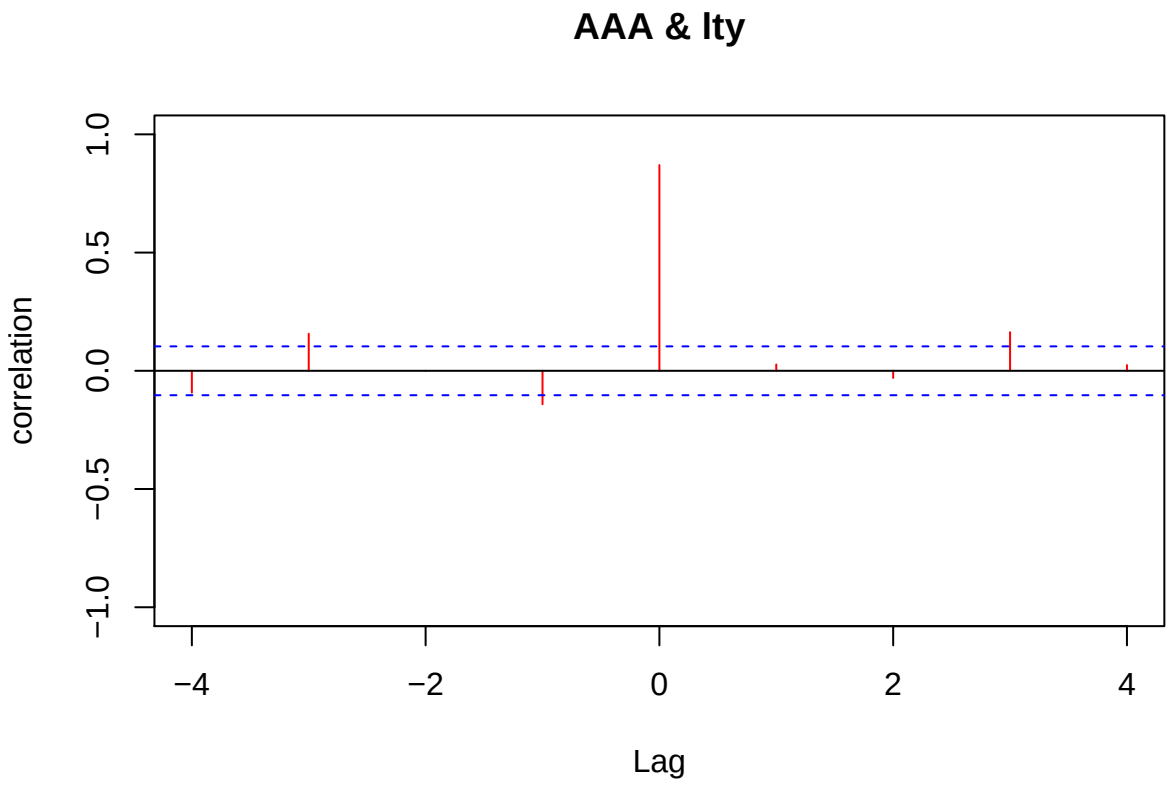

```
ccf(AAA, AAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



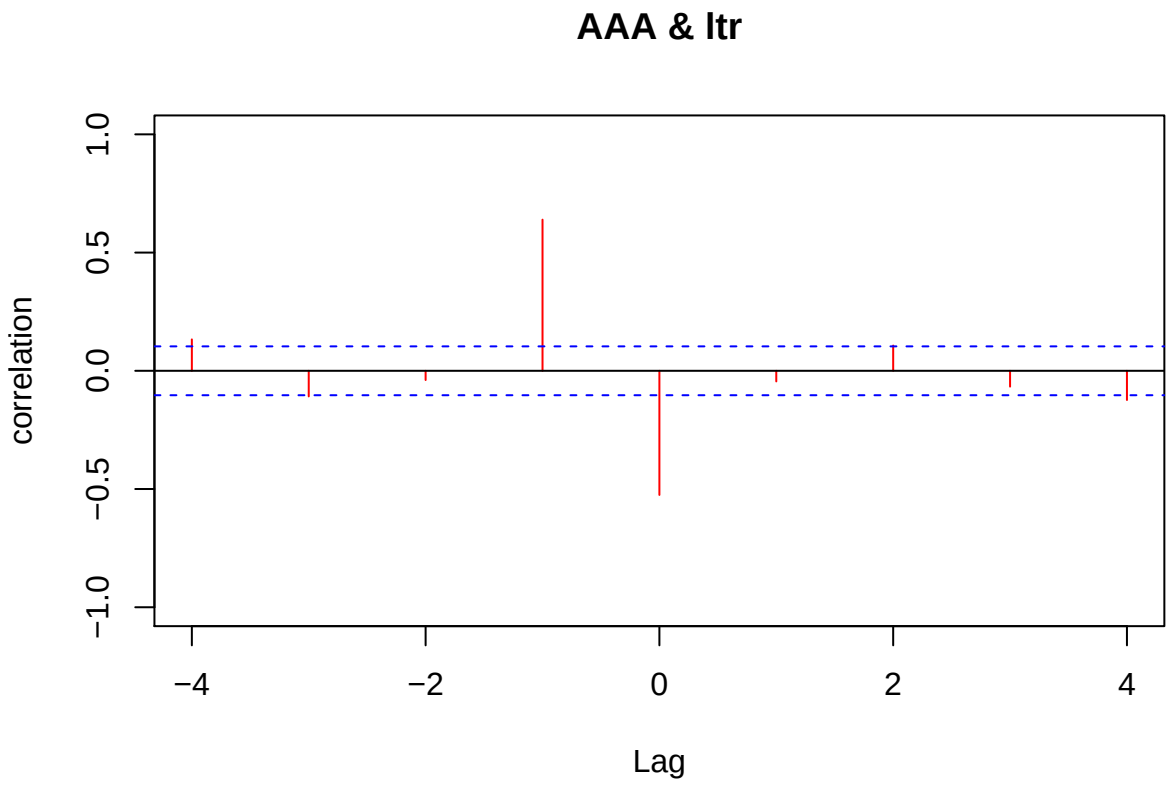

```
ccf(AAA,  BAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



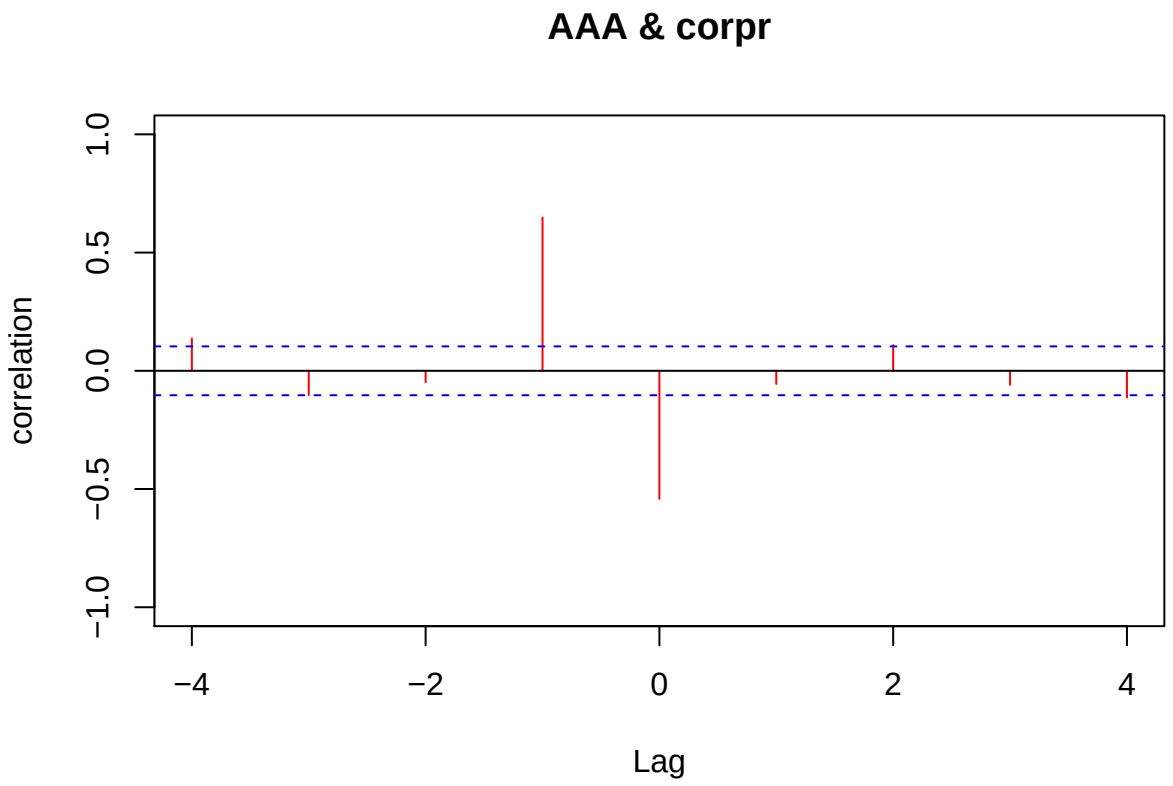

```
ccf(AAA, lty, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



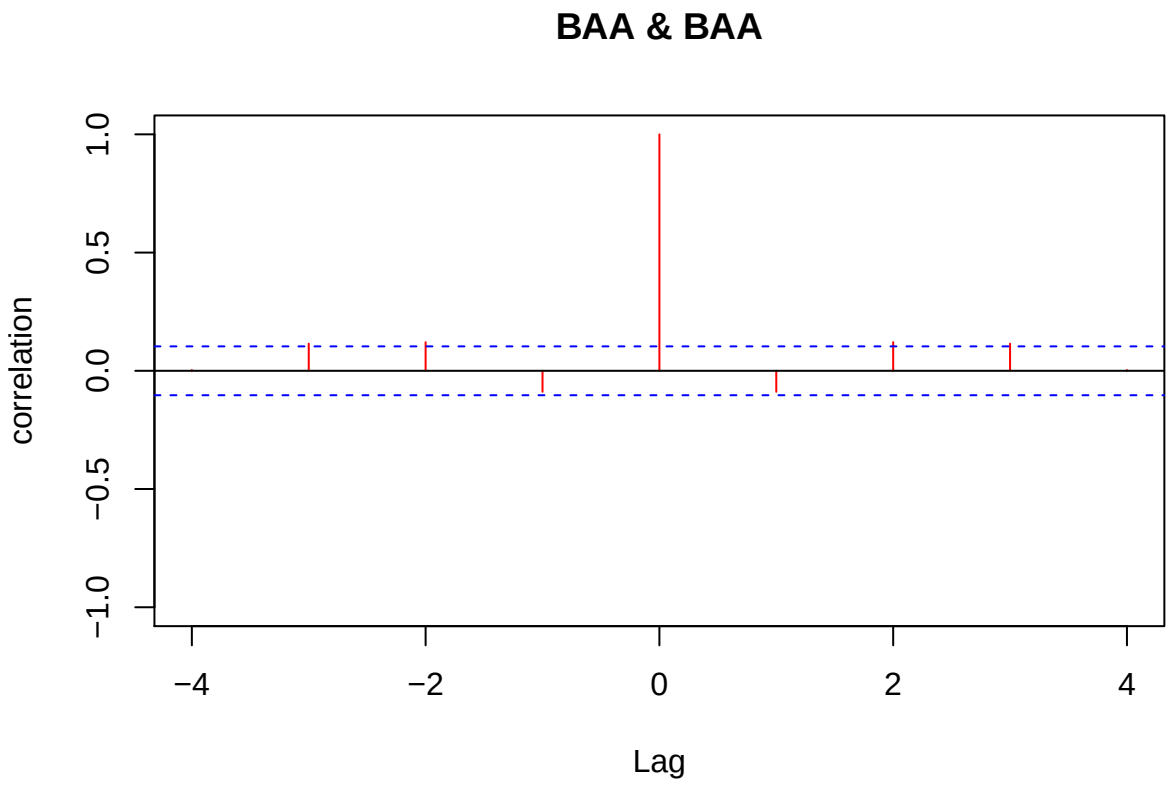

```
ccf(AAA, ltr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



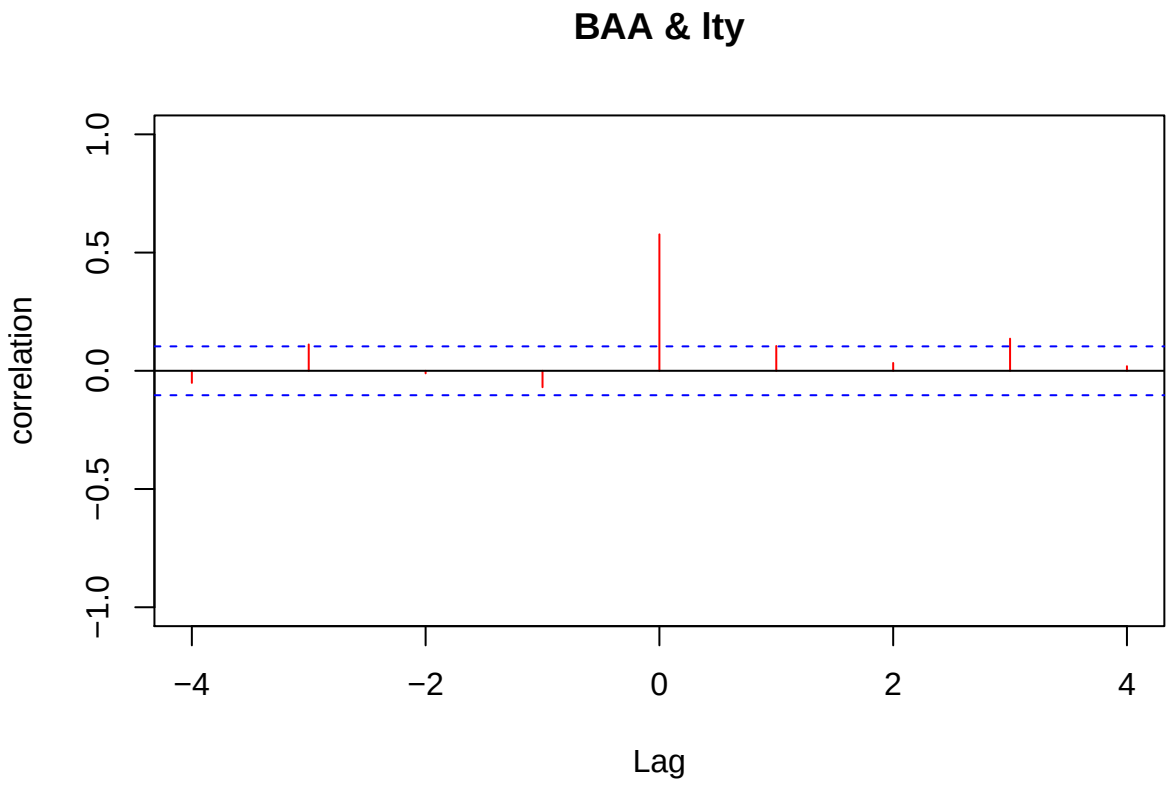

```
ccf(AAA, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



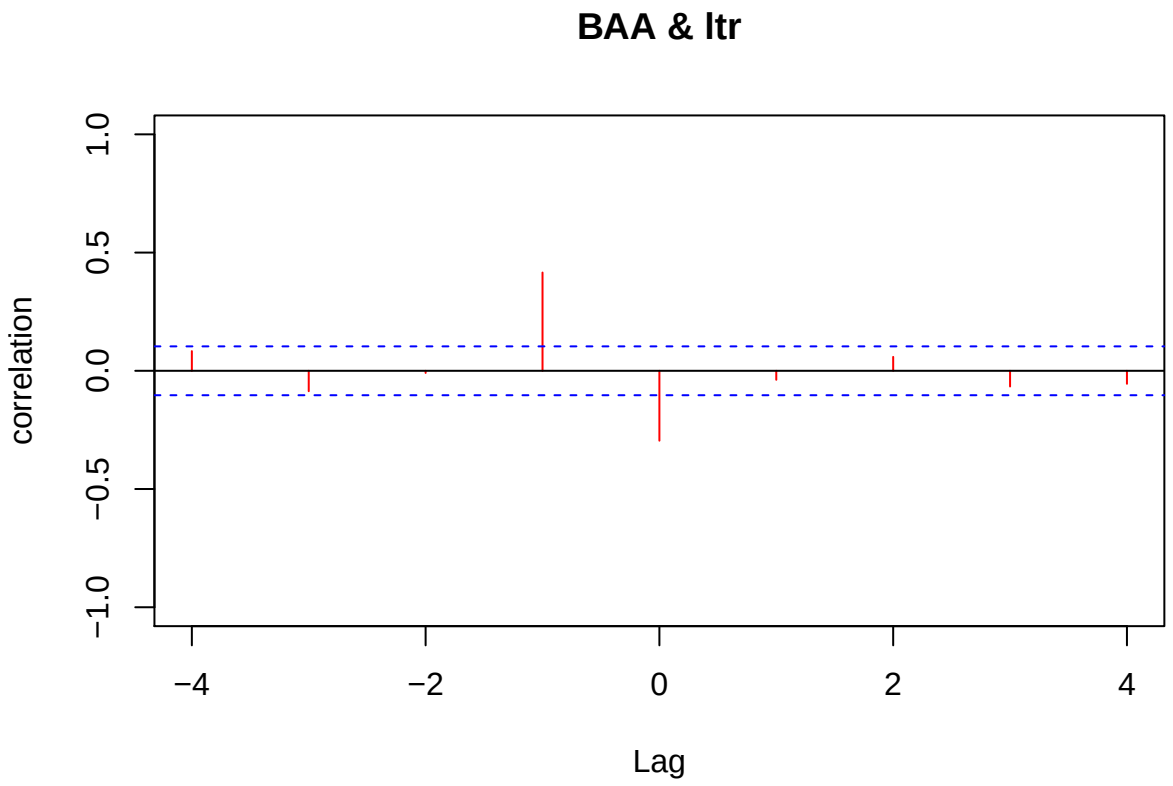

```
ccf(BAA, BAA, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



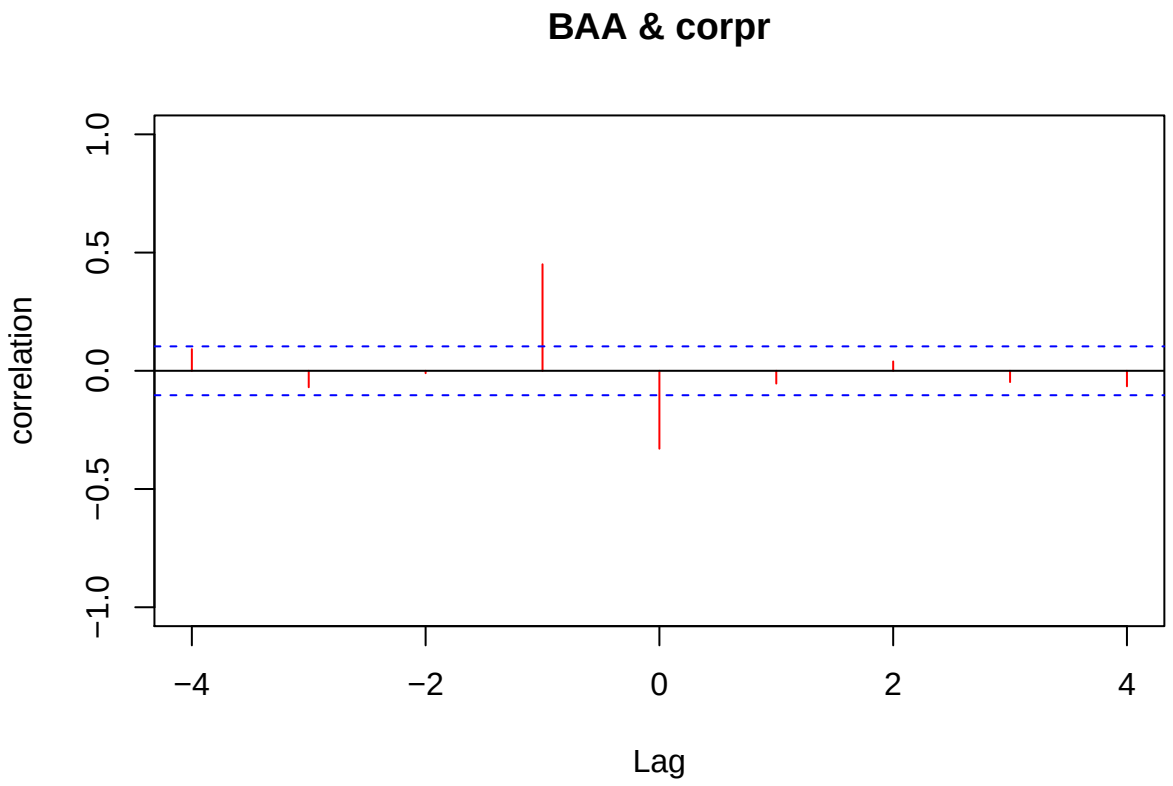

```
ccf(BAA, lty, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



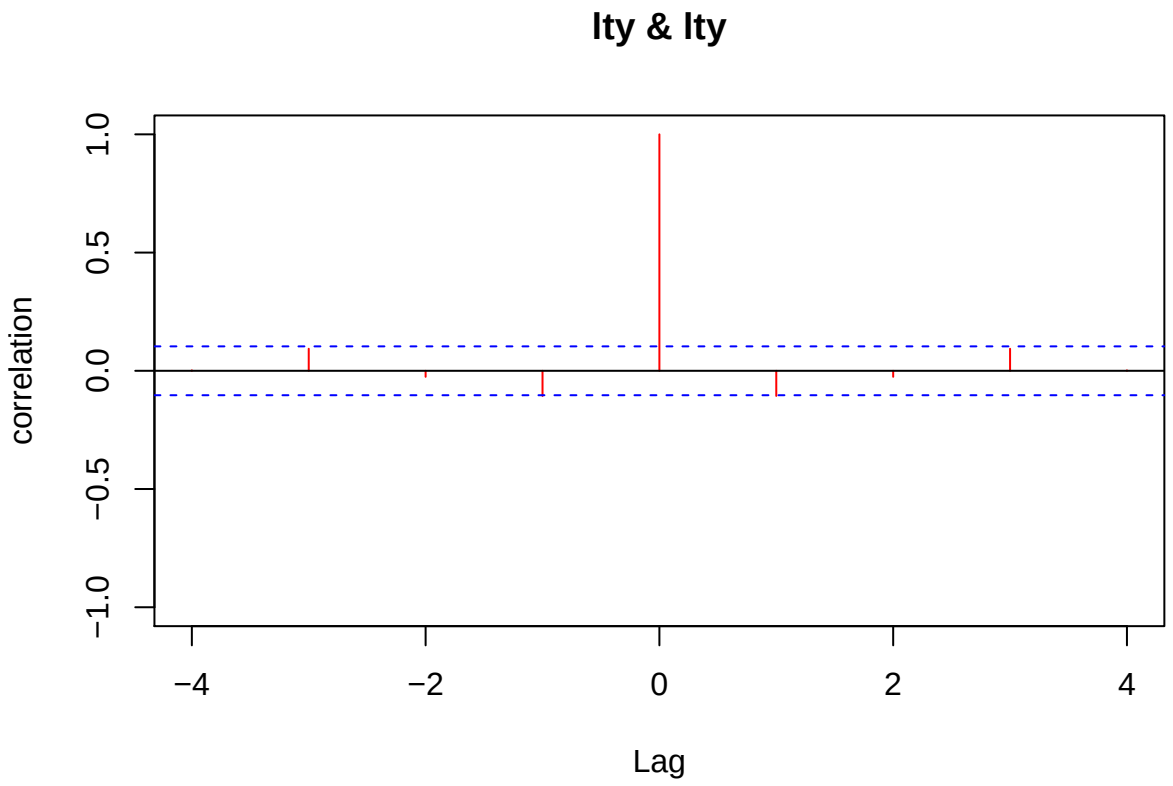

```
ccf(BAA, ltr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



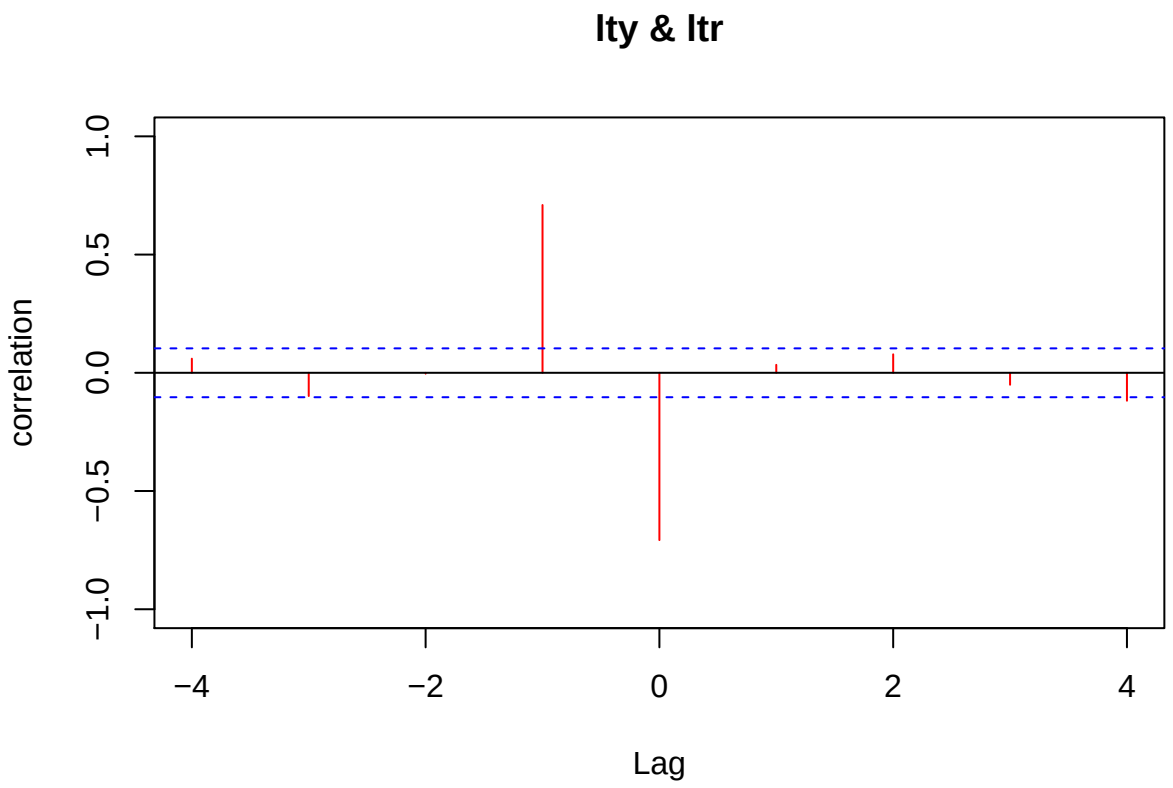

```
ccf(BAA, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



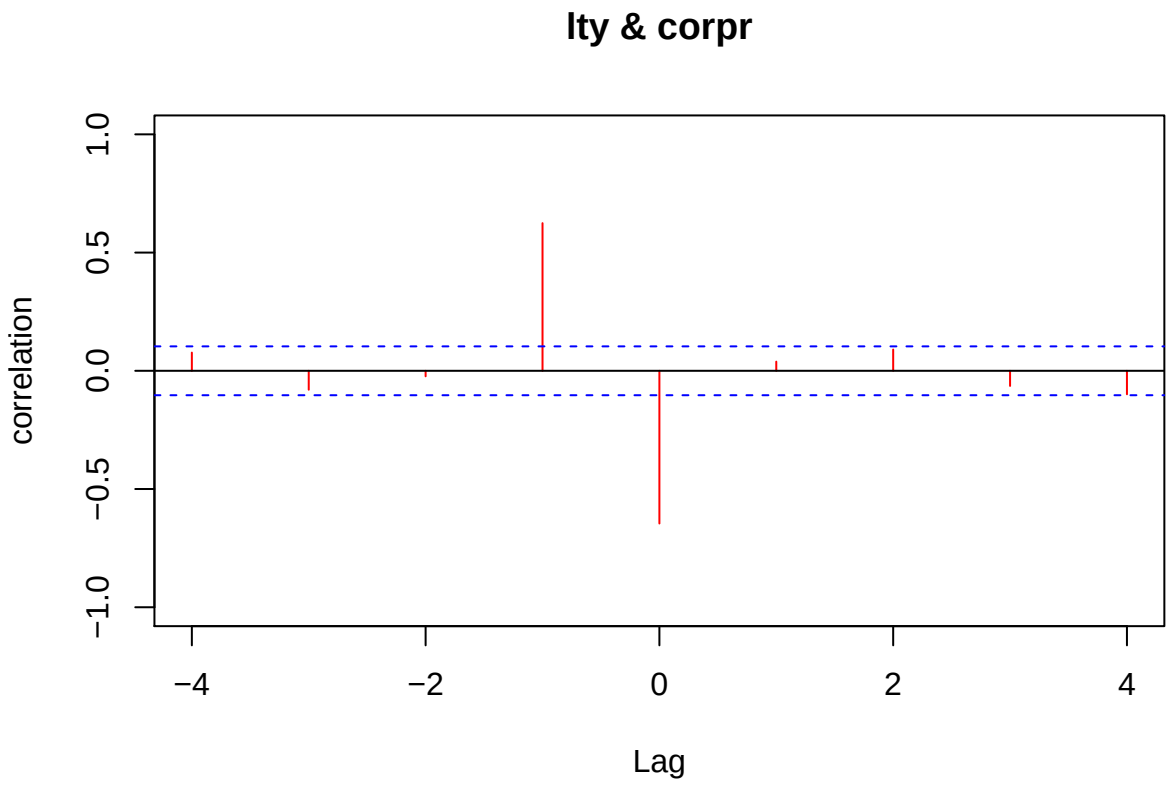

```
ccf(lty, lty, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



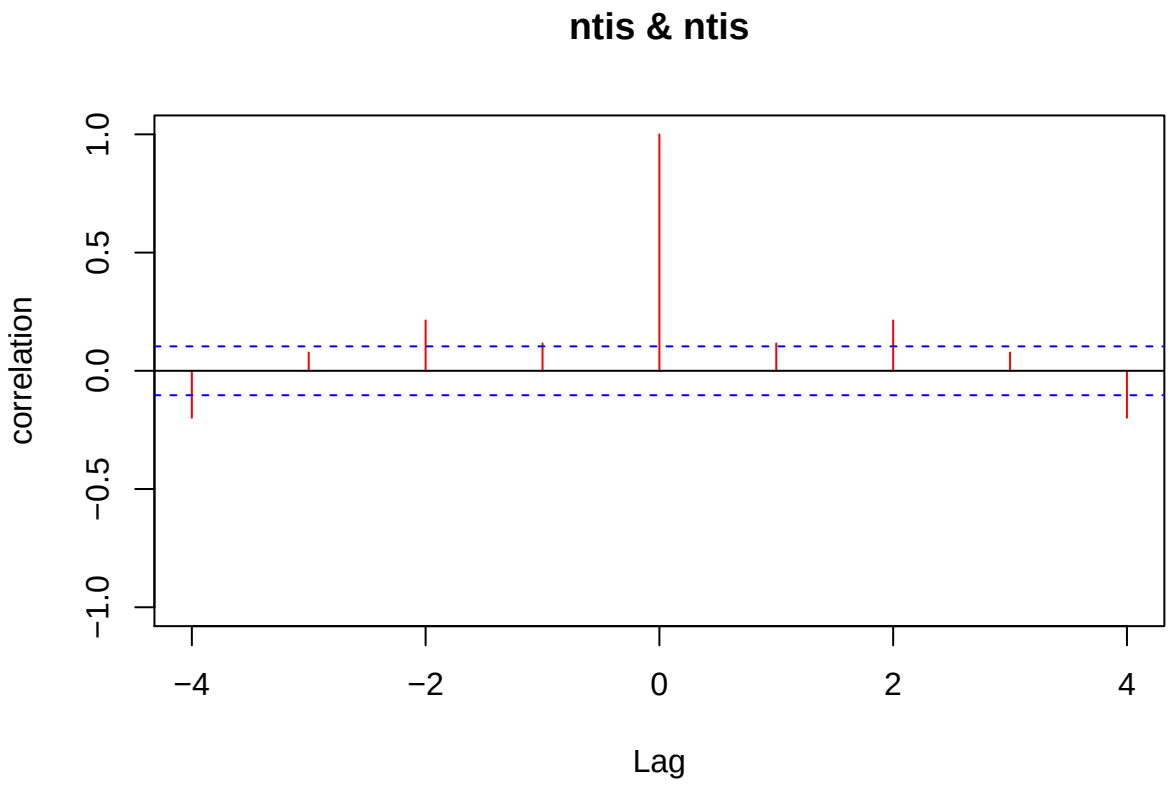

```
ccf(lty, ltr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



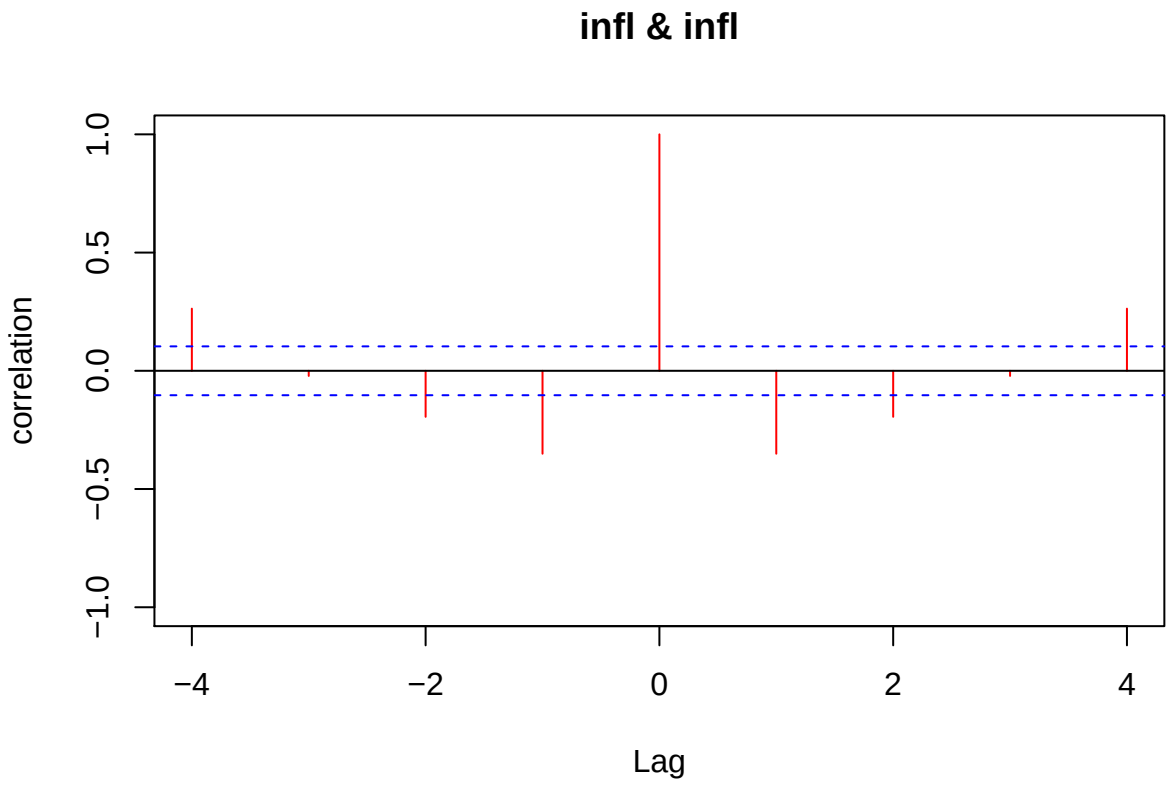

```
ccf(lty, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



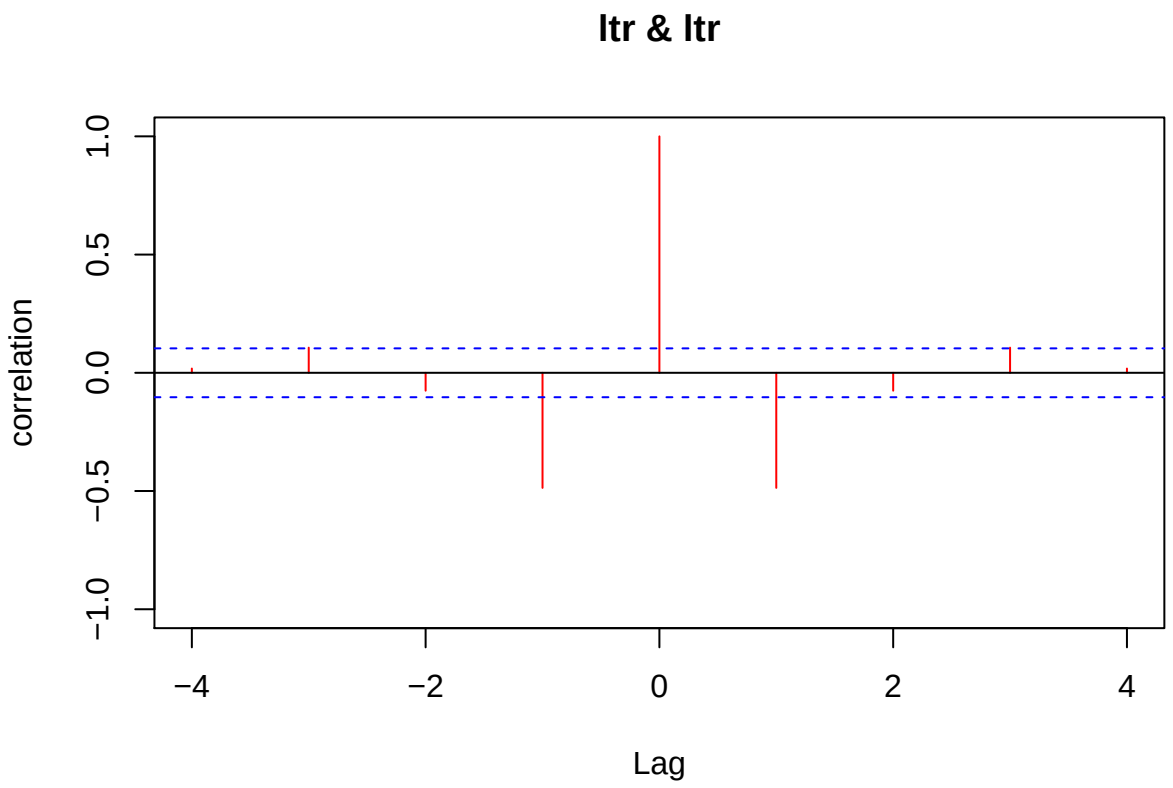

```
ccf(ntis, ntis, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



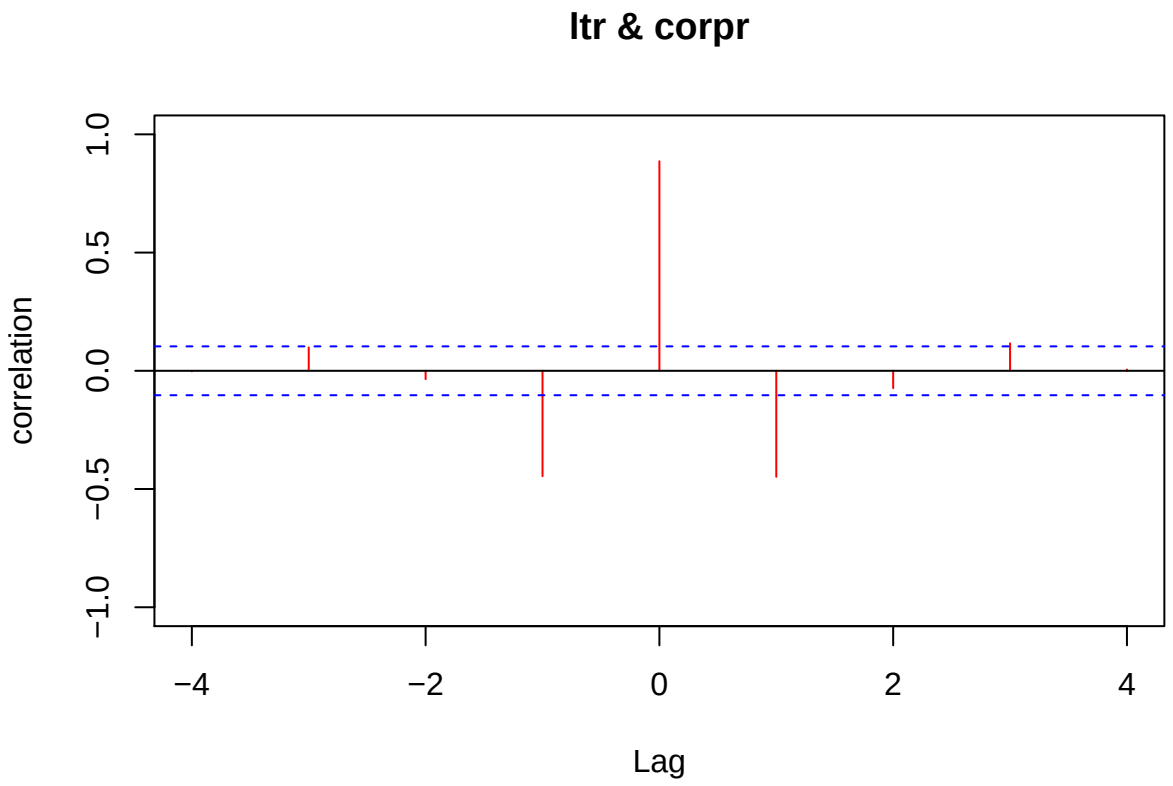

```
ccf(infl, infl, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



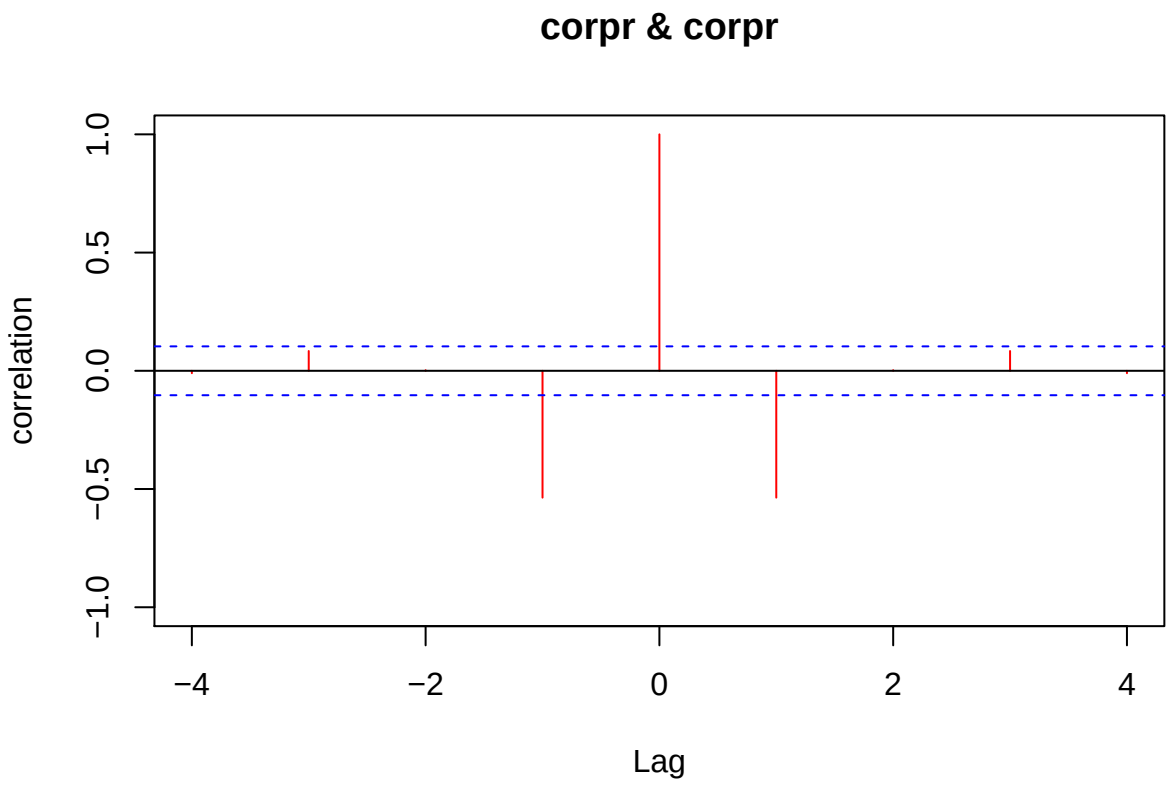

```
ccf(ltr, ltr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



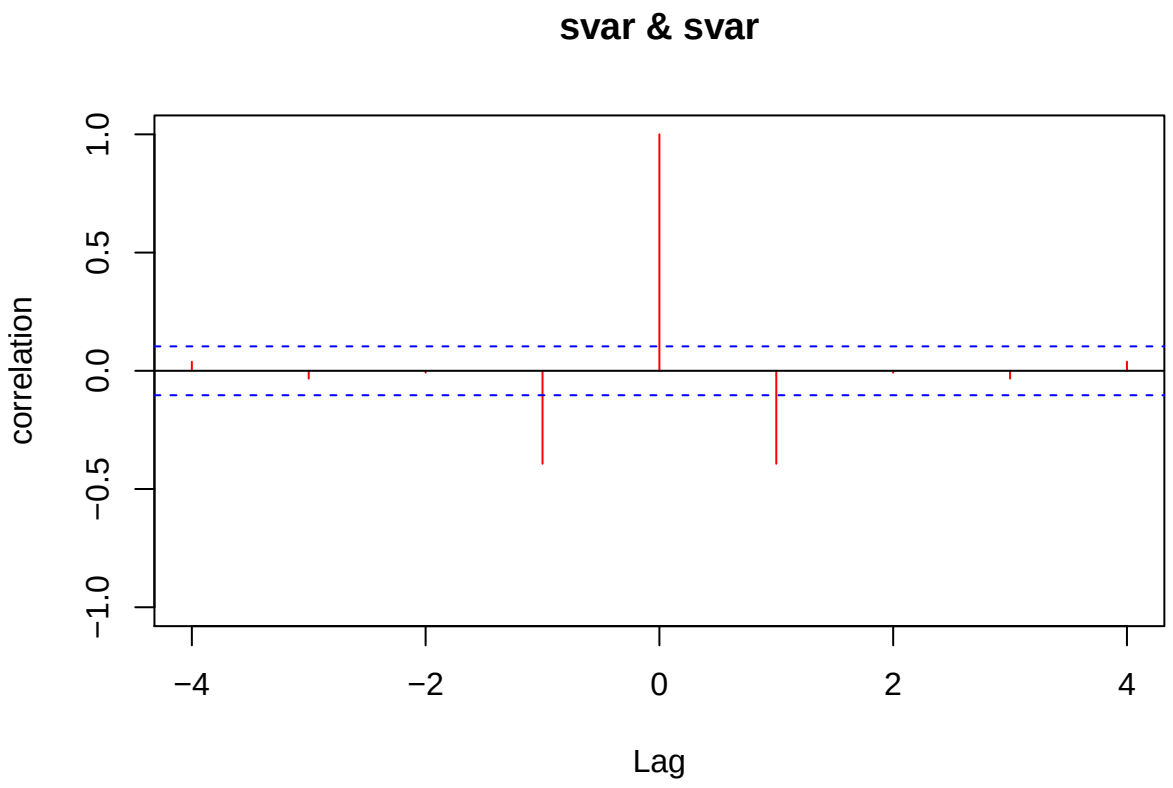

```
ccf(ltr, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



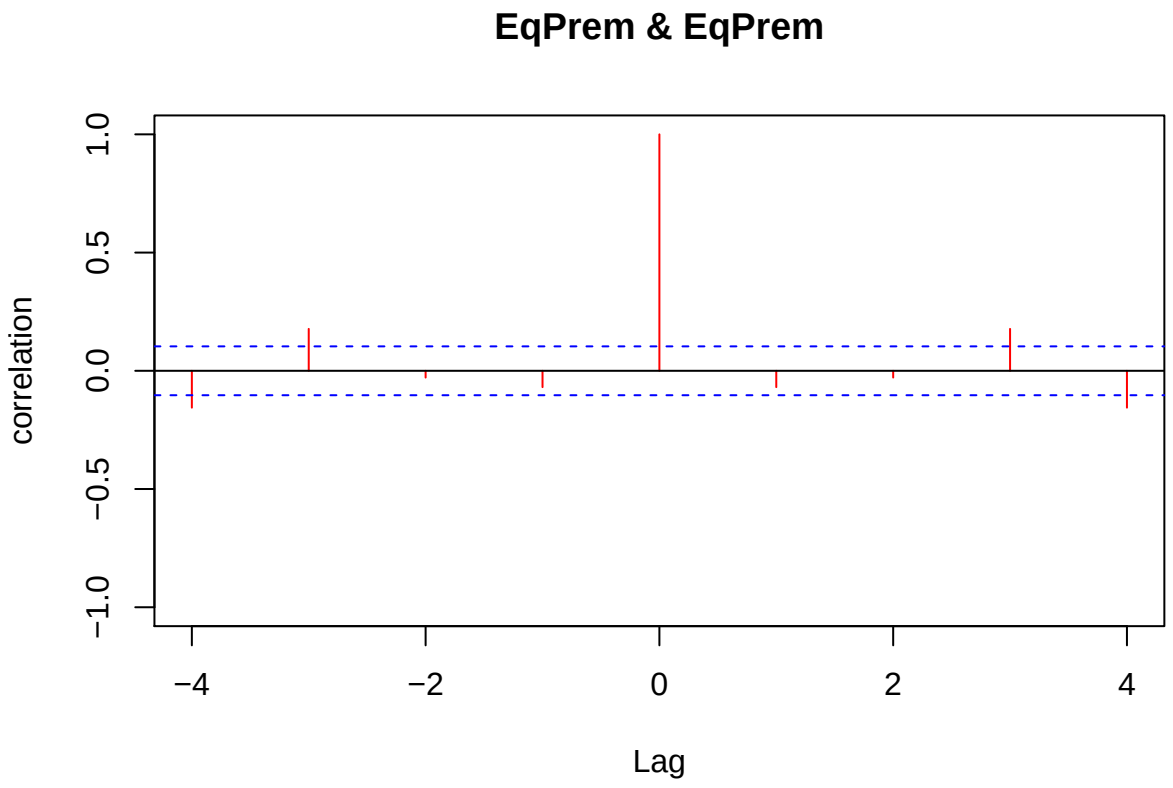

```
ccf(corpr, corpr, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```




```
ccf(svar, svar, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```




```
ccf(EqPrem, EqPrem, ylab="correlation", lag.max=4, ylim=c(-1,1), col="red")
```



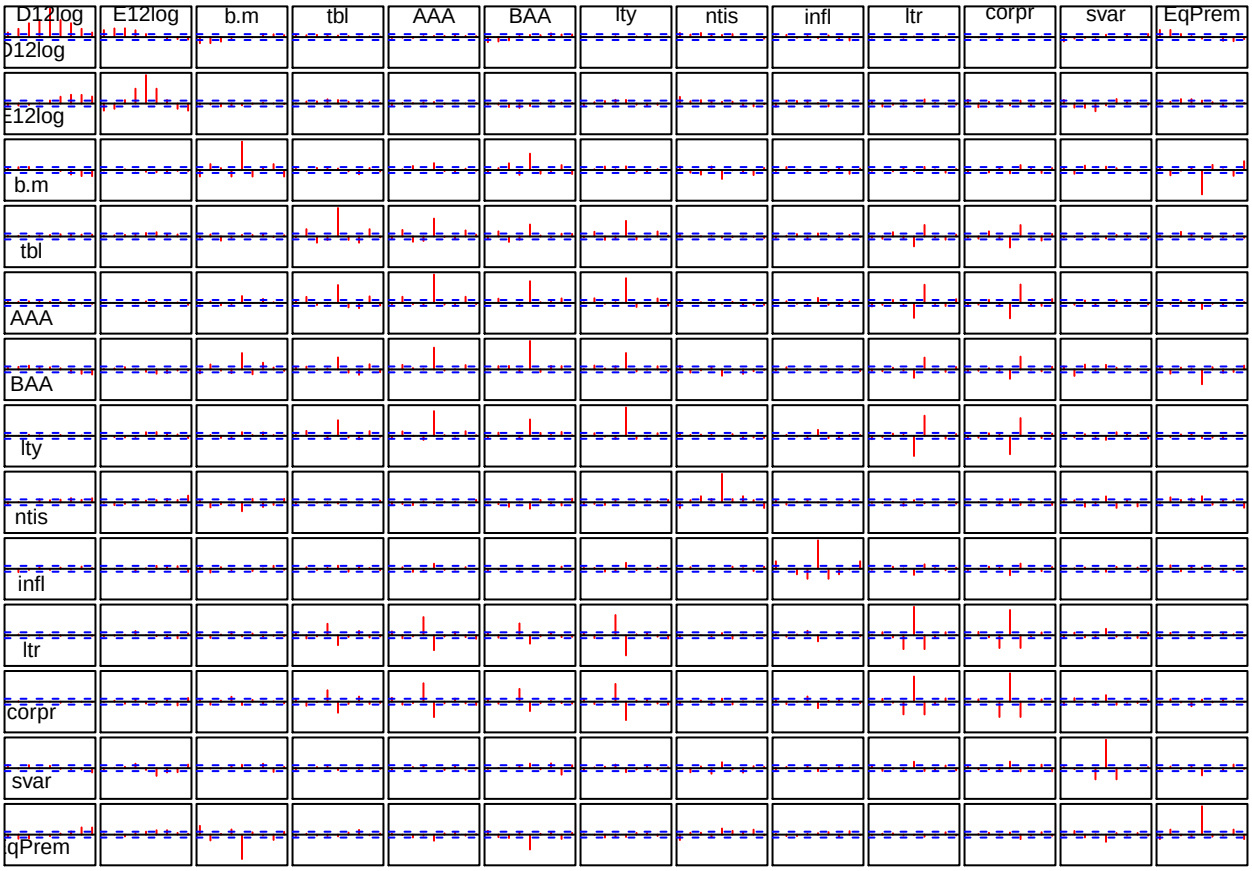

### All pairwise correlations of first differences (and raw EqPrem) with leads and lags

- above are the ones that look interesting, all below for reference)

```
# cartesian product of column numbers
mygrid = expand.grid(c(1:ncol(corrdata)), c(1:ncol(corrdata)))
#make upper triangular
#commented out because I don't know how to make ccf skip empty slots
#mygrid <- mygrid[!(mygrid$Var1<mygrid$Var2),]

# function that takes 2 column numbers, runs ccf on corresponding 2 cols in corrdata
myccf <- function(i, j) {
      iname=colnames(corrdata)[i]
      jname=colnames(corrdata)[j]
      mytitle = paste(iname, jname, sep=" vs. ")
#      if (i<j) {
#        plot.new()
#      }
#      else {
        ccf(corrdata[,i], corrdata[,j], ylim=c(-1,1), ylab="",xlab="", main=iname, lag.max=4, col="red"
        if (i==1 ) {
          text(labels=jname, x=-1.75, y=-0.5)
        }
        if (j==1 ) {
          text(labels=iname, x=0, y=0.75)
          }
      #}
}
```

```
# run charts of correlations with leads and lags
# run in grid, # no axis labels, # no margins
```

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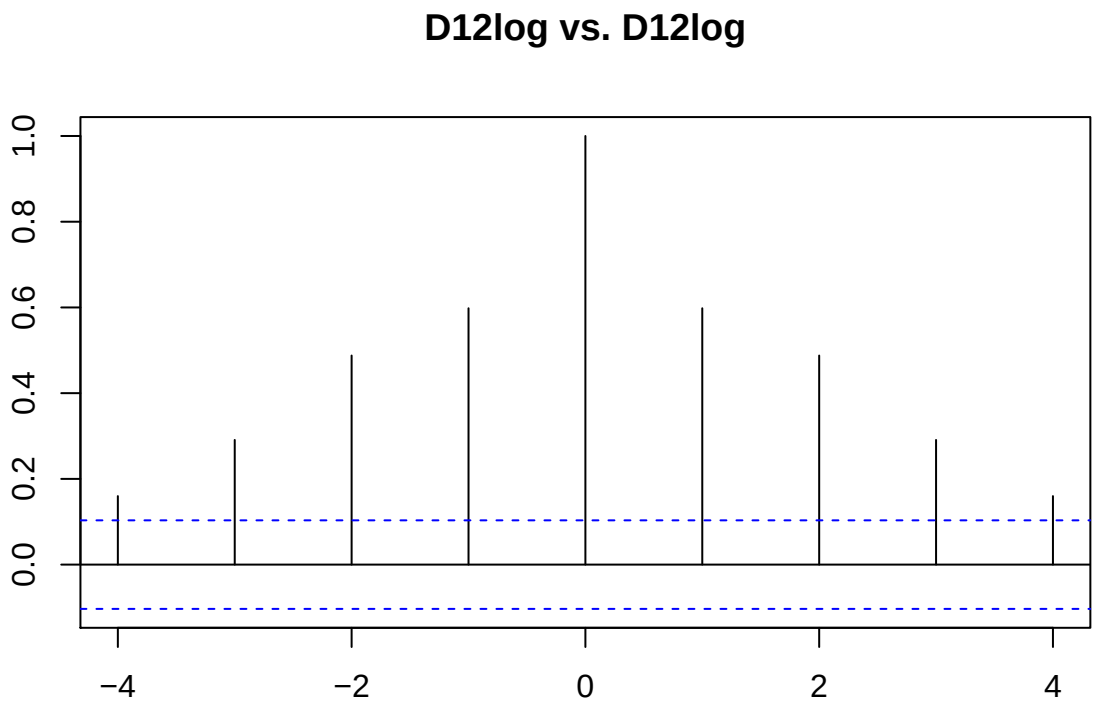
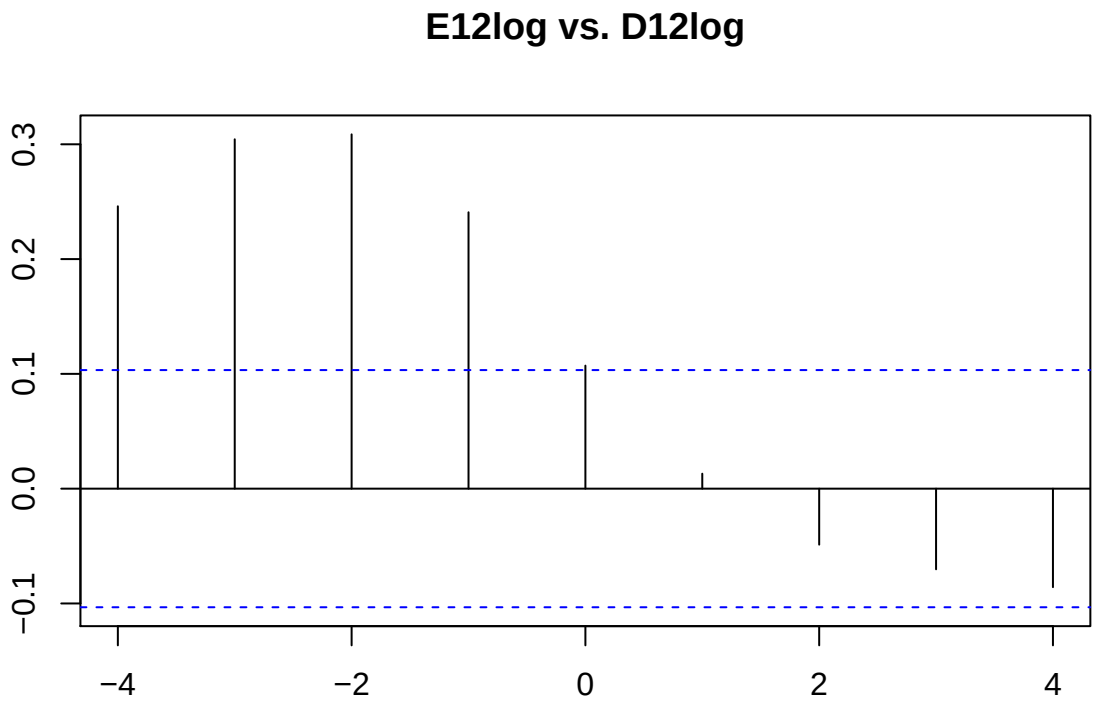
```

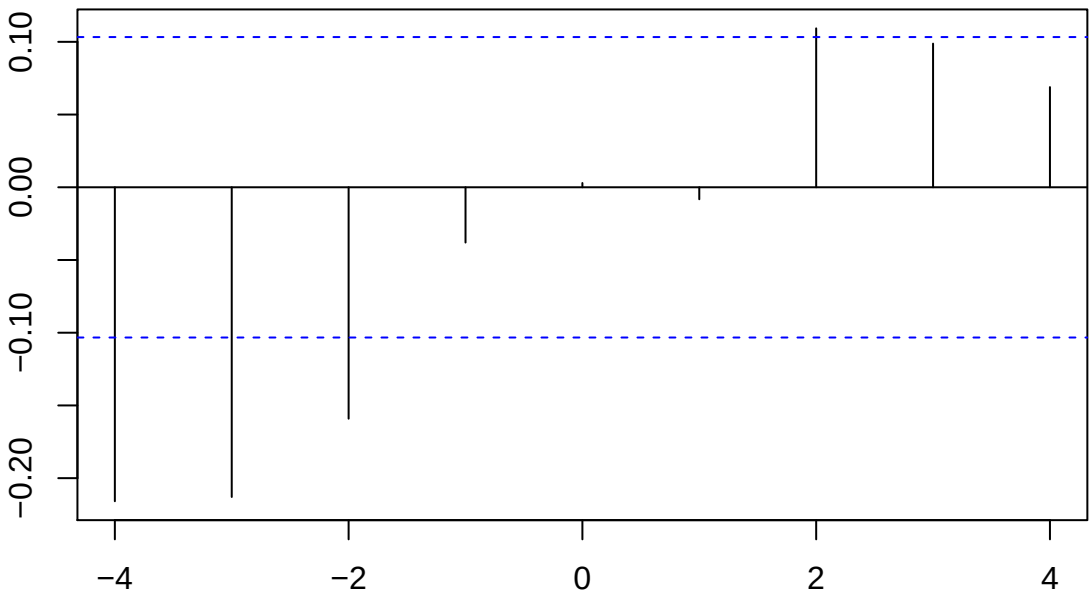
### All charts from grid full size for reference

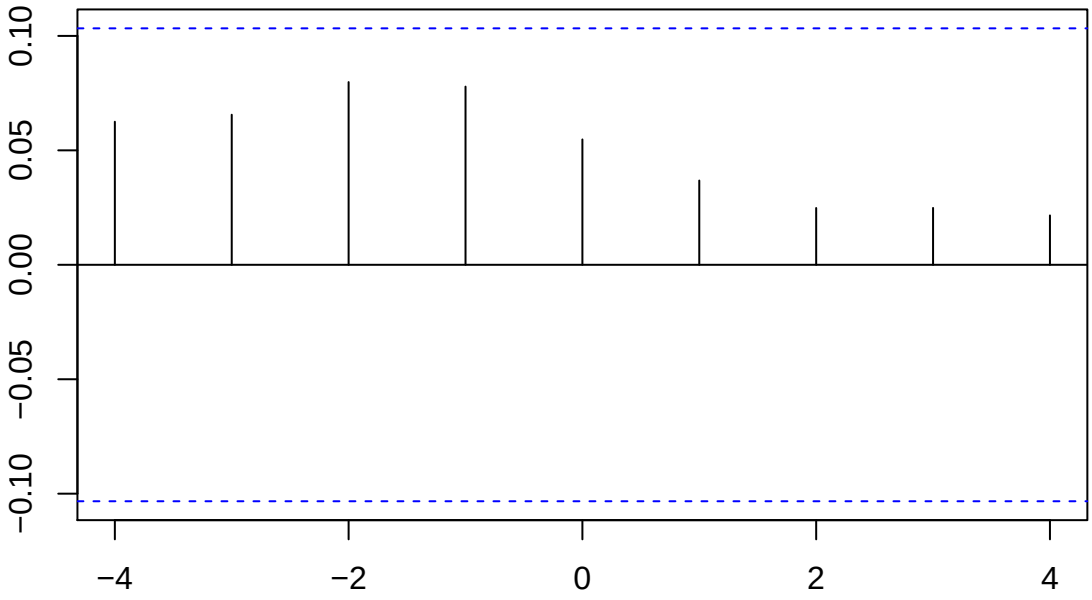
```
#grid has limited usefulness without improving aesthetics...run all sequentially
myccf <- function(i, j) {
      iname=colnames(corrdata)[i]
      jname=colnames(corrdata)[j]
      mytitle = paste(iname, jname, sep=" vs. ")
      ccf(corrdata[,i], corrdata[,j], ylab="", xlab="", main=mytitle, lag.max=4)
}

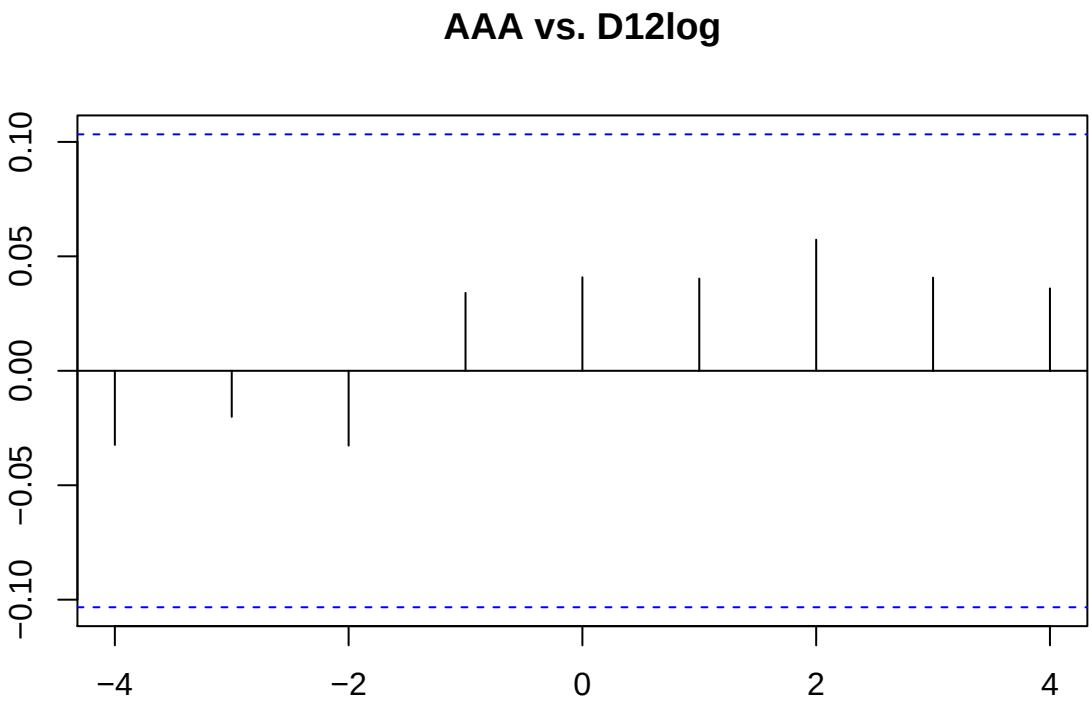
#make upper triangular
mygrid <- mygrid[!(mygrid$Var1<mygrid$Var2),]
par(old.par)
mapply(myccf, mygrid$Var1, mygrid$Var2)
```

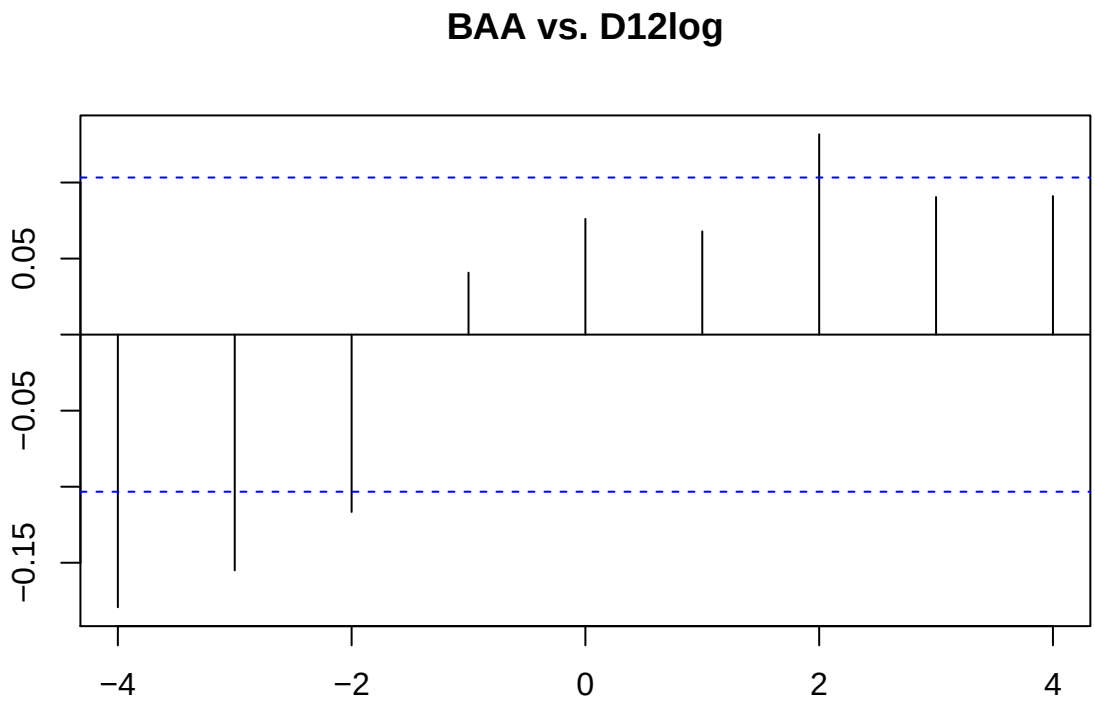


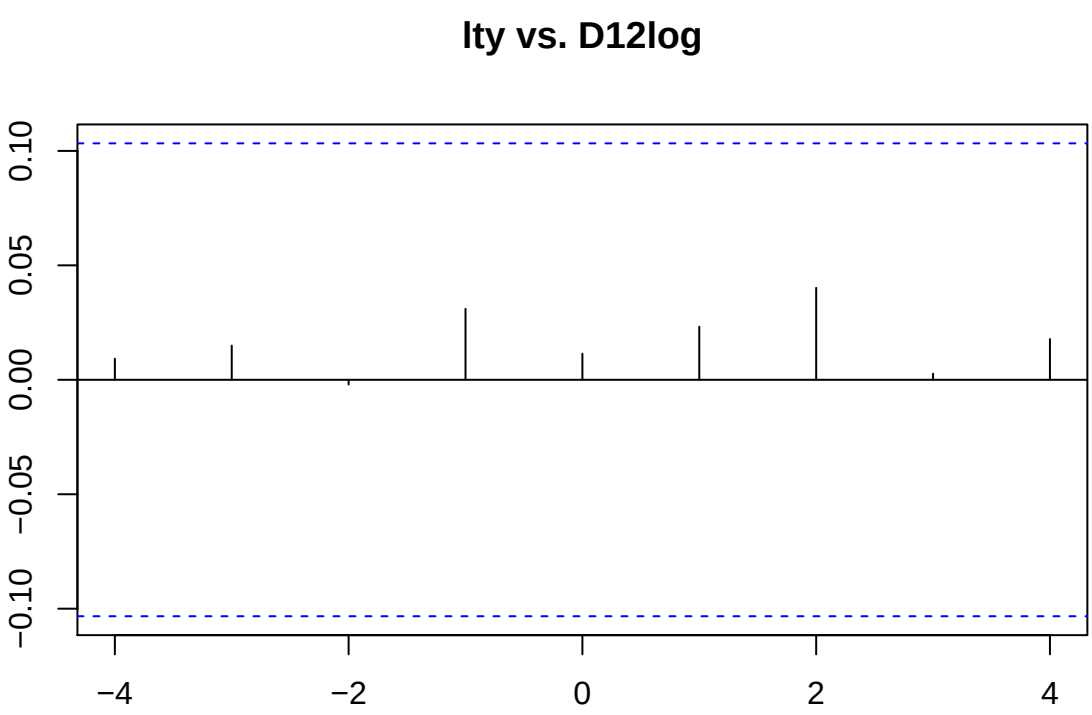

E12log vs. D12log
0.3
0.2
0.1
0.0
−0.1
−4
−2
0
2
4

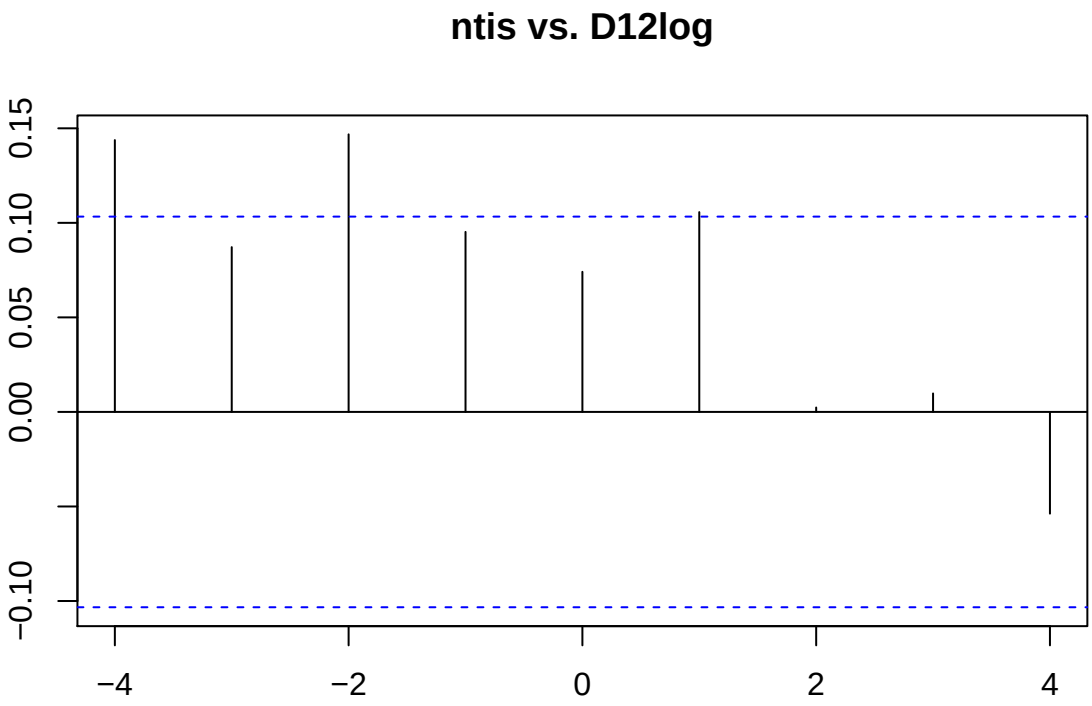

b.m vs. D12log
0.10
0.00
−0.10
−0.20
−4
−2
0
2
4

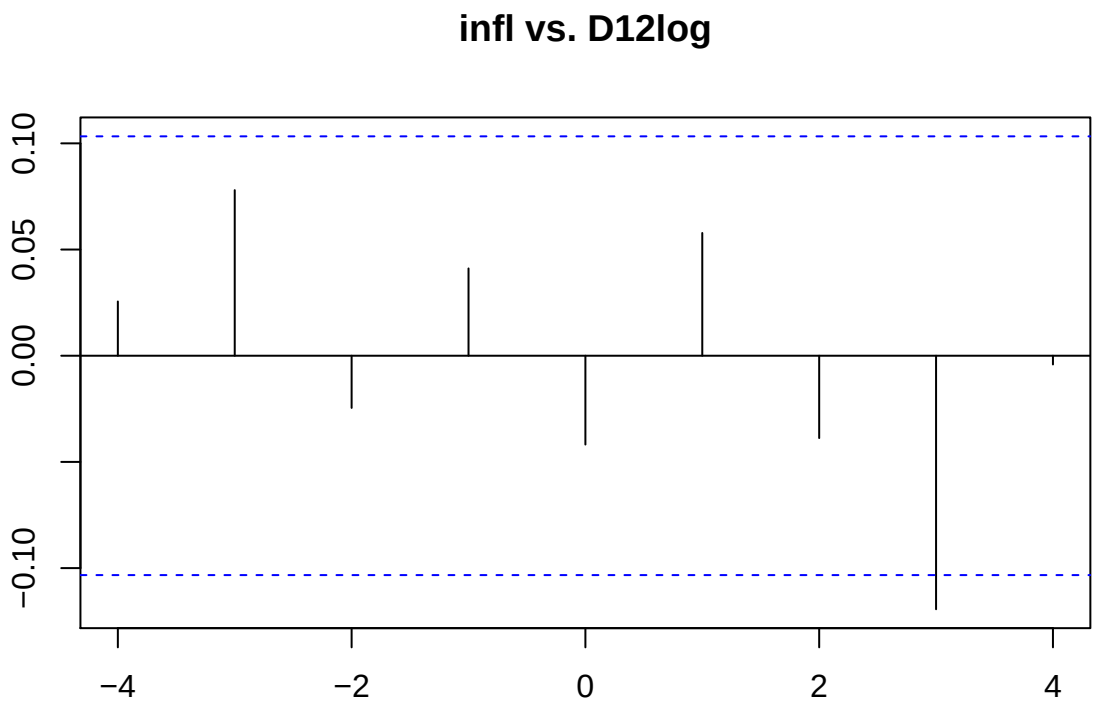

tbl vs. D12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

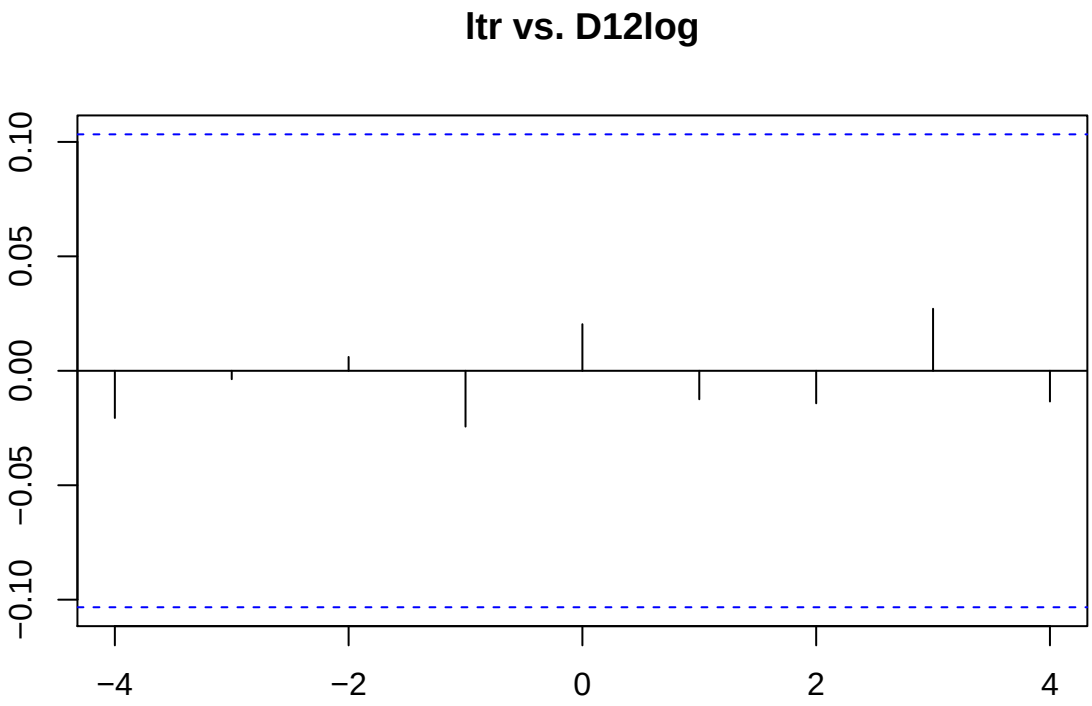

AAA vs. D12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

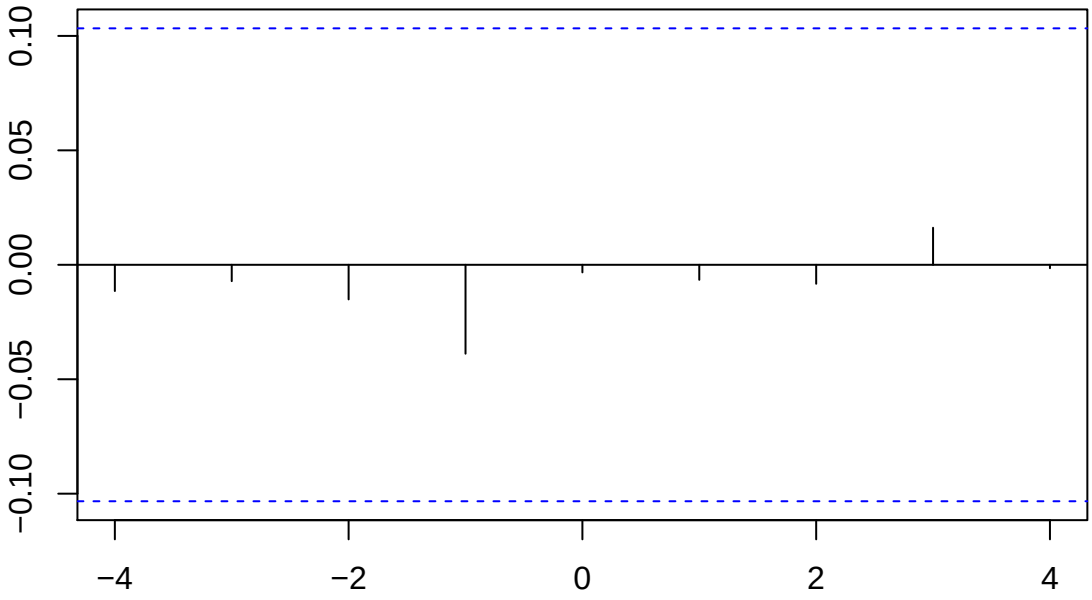

BAA vs. D12log
0.05
−0.05
−0.15
−4
−2
0
2
4

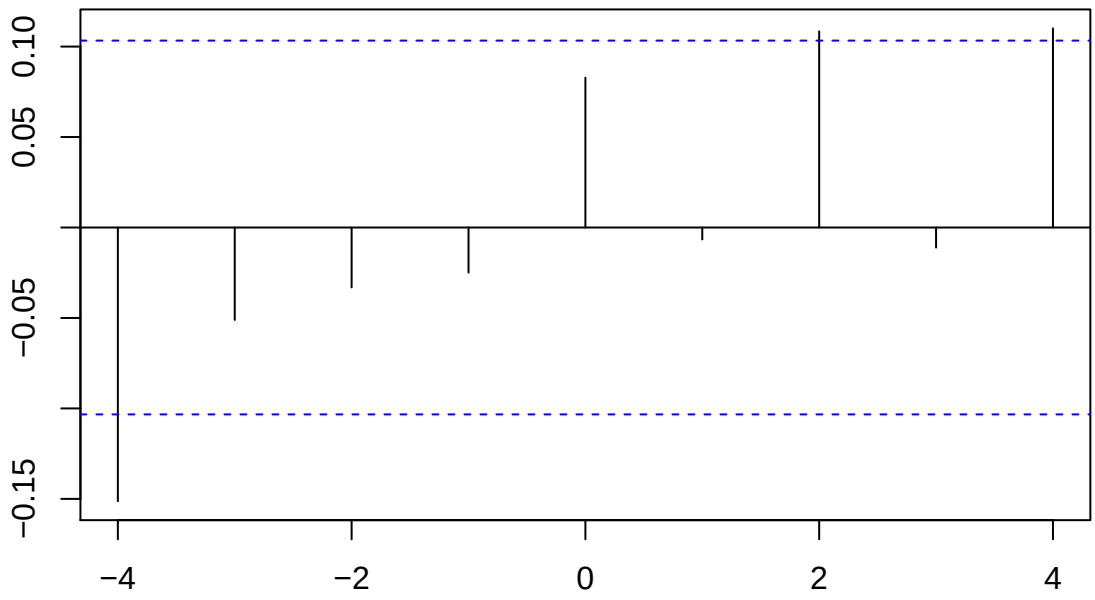

lty vs. D12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

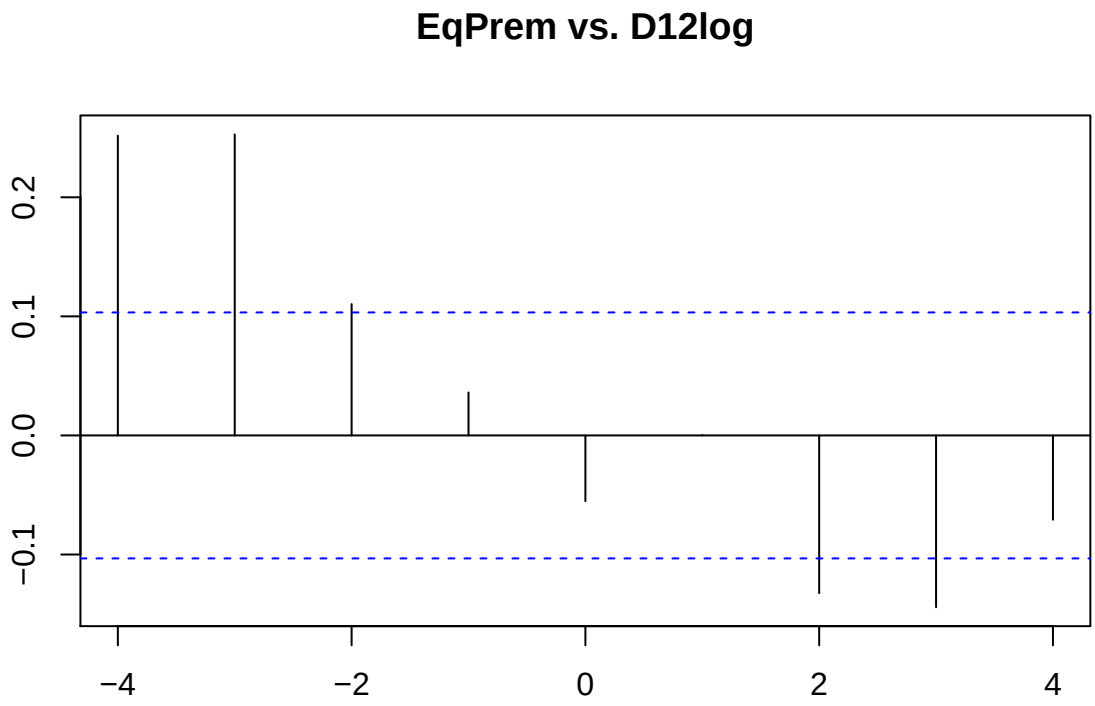

ntis vs. D12log
0.15
0.10
0.05
0.00
−0.10
−4
−2
0
2
4

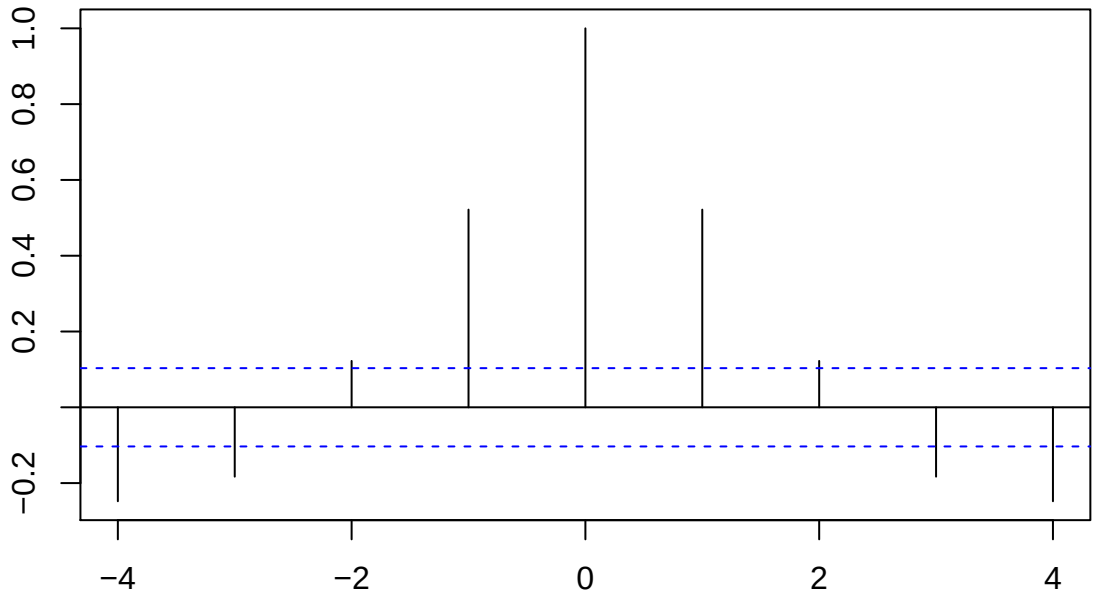

infl vs. D12log
0.10
0.05
0.00
−0.10
−4
−2
0
2
4

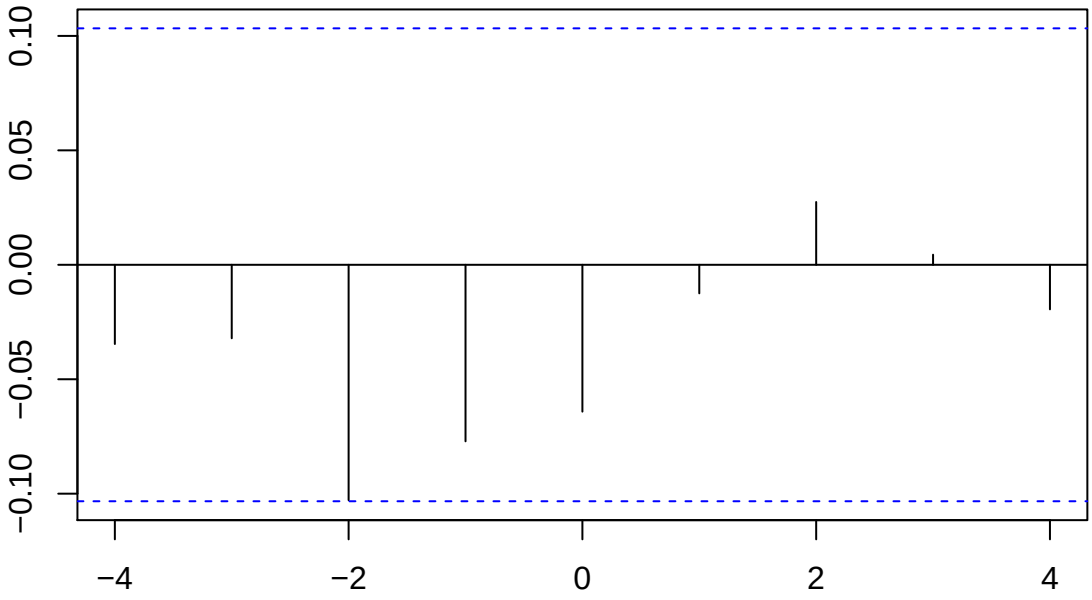

ltr vs. D12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

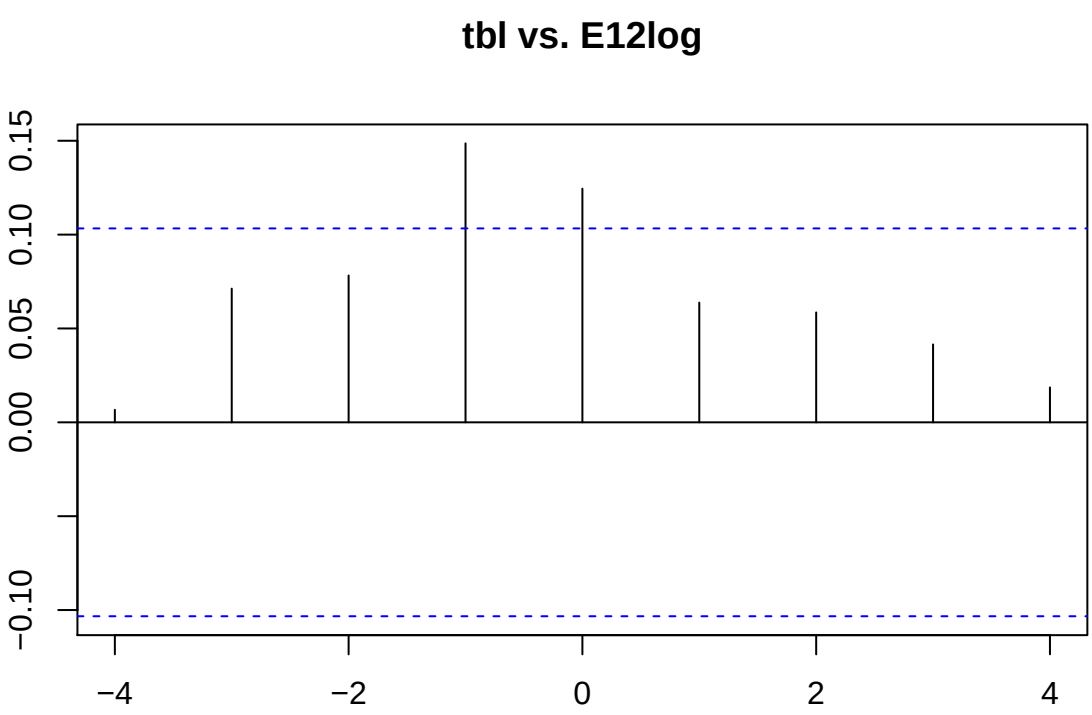

corpr vs. D12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

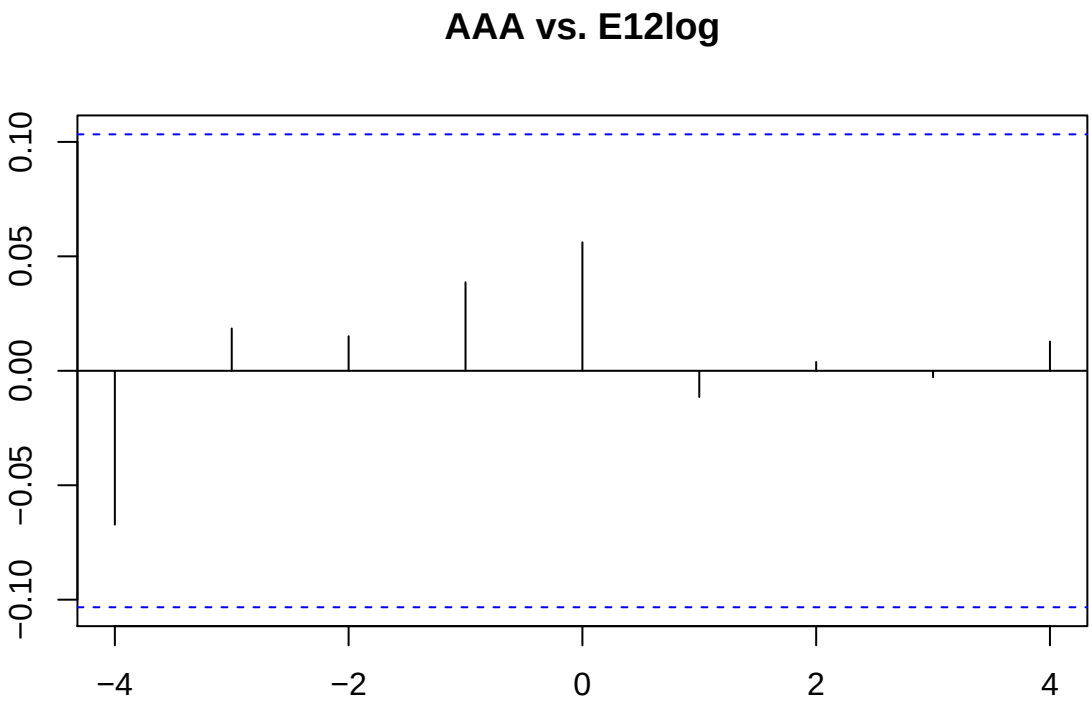

svar vs. D12log
0.10
0.05
−0.05
−0.15
−4
−2
0
2
4

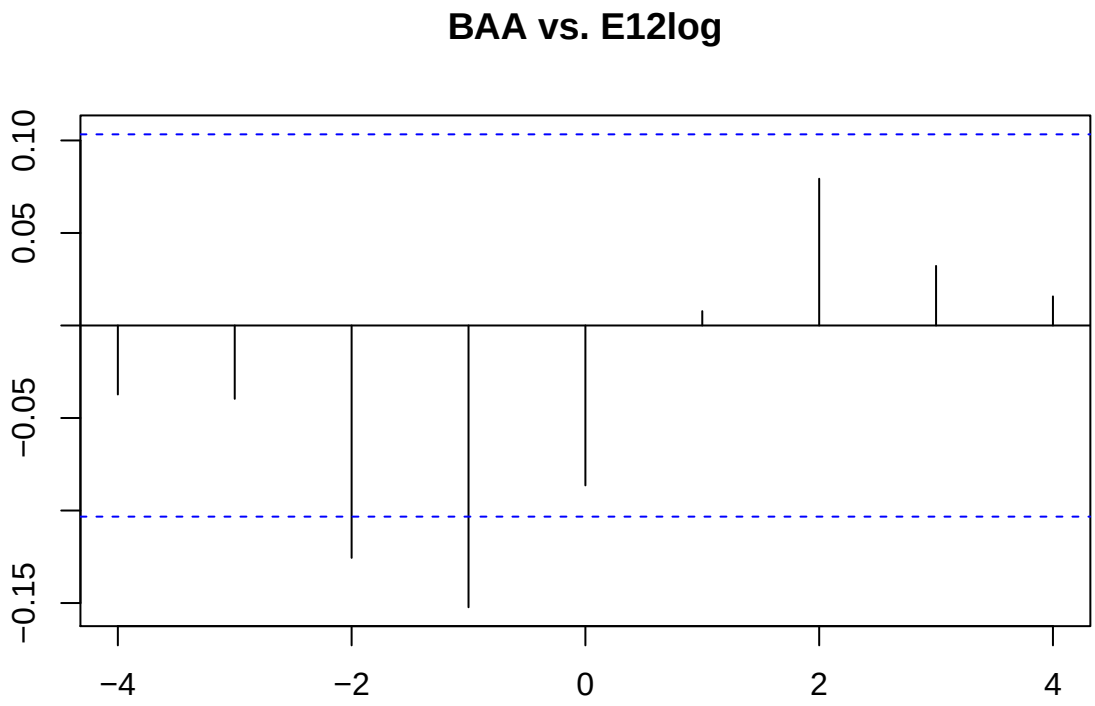

EqPrem vs. D12log
0.2
0.1
0.0
−0.1
−4
−2
0
2
4


E12log vs. E12log
1.0
0.8
0.6
0.4
0.2
−0.2
−4
−2
0
2
4


b.m vs. E12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4


tbl vs. E12log
0.15
0.10
0.05
0.00
−0.10
−4
−2
0
2
4


AAA vs. E12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4


BAA vs. E12log
0.10
0.05
−0.05
−0.15
−4
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0
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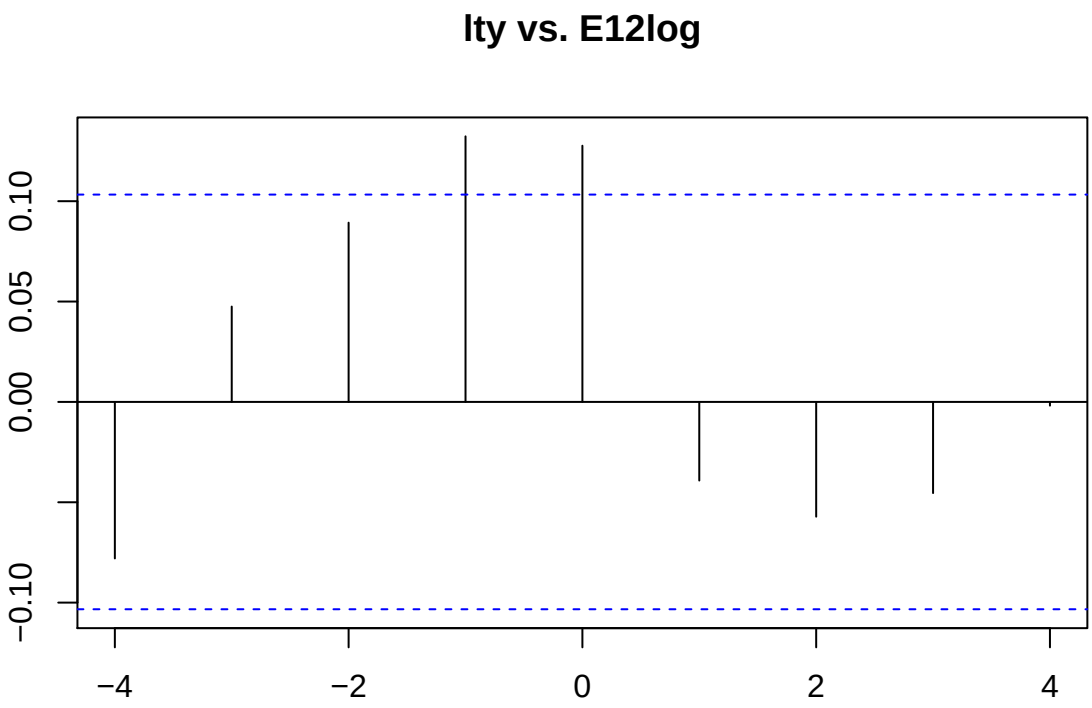
lty vs. E12log
0.10
0.05
0.00
−0.10
−4
−2
0
2
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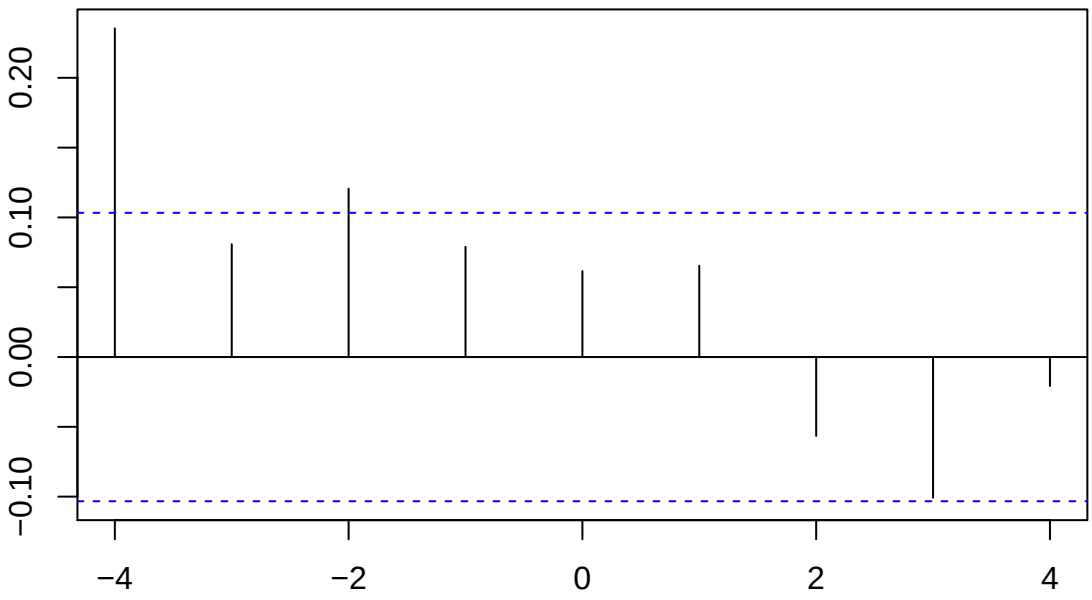
ntis vs. E12log
0.20
0.10
0.00
−0.10
−4
−2
0
2
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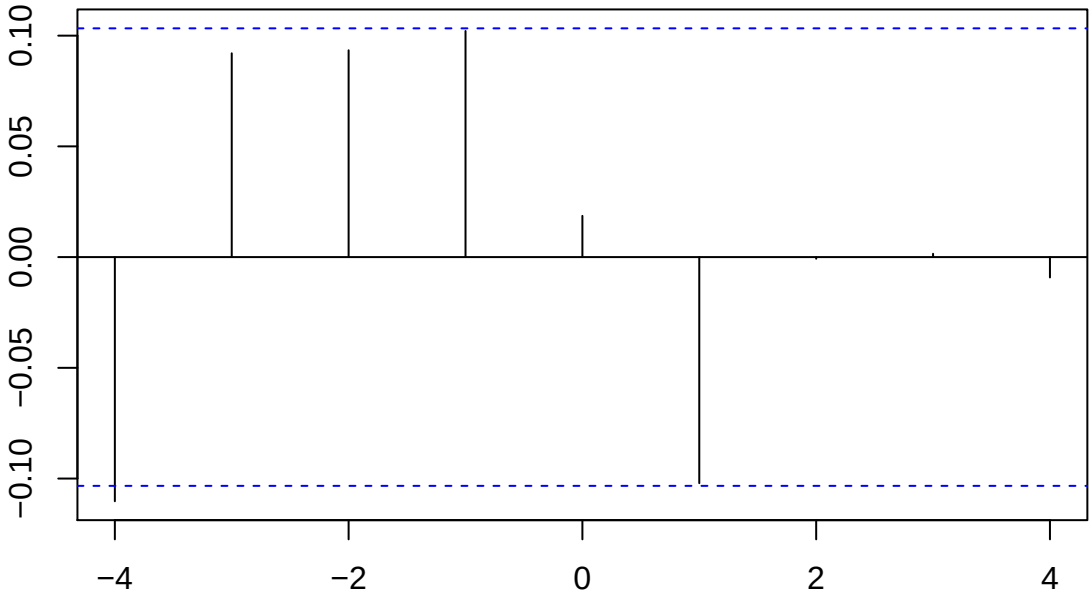
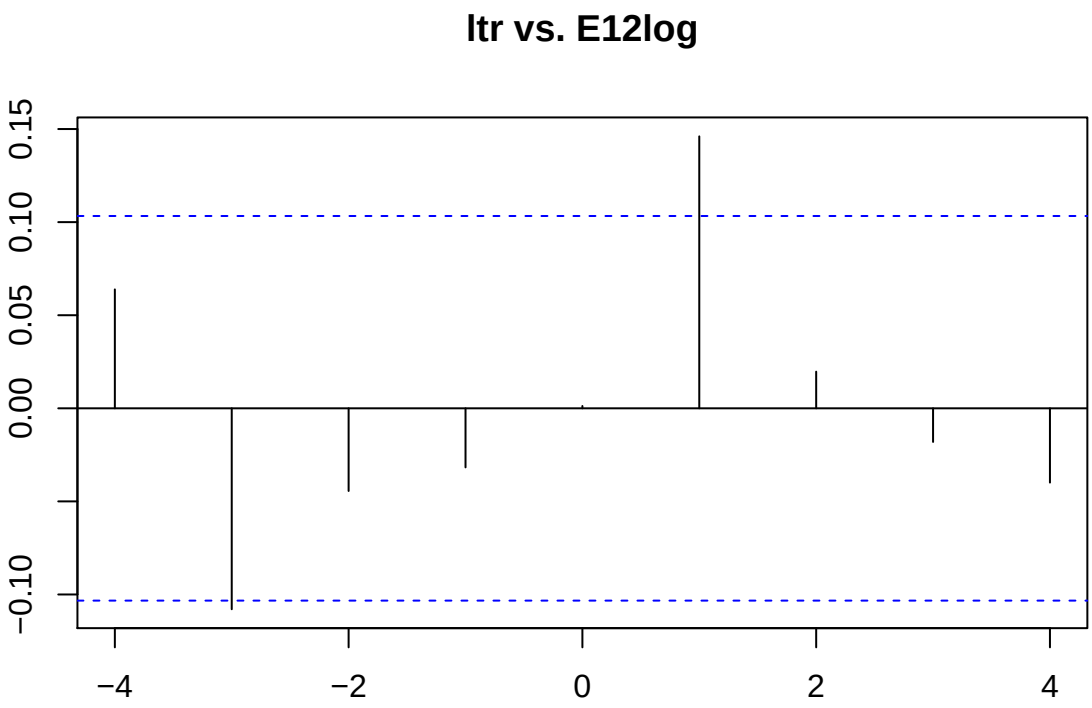
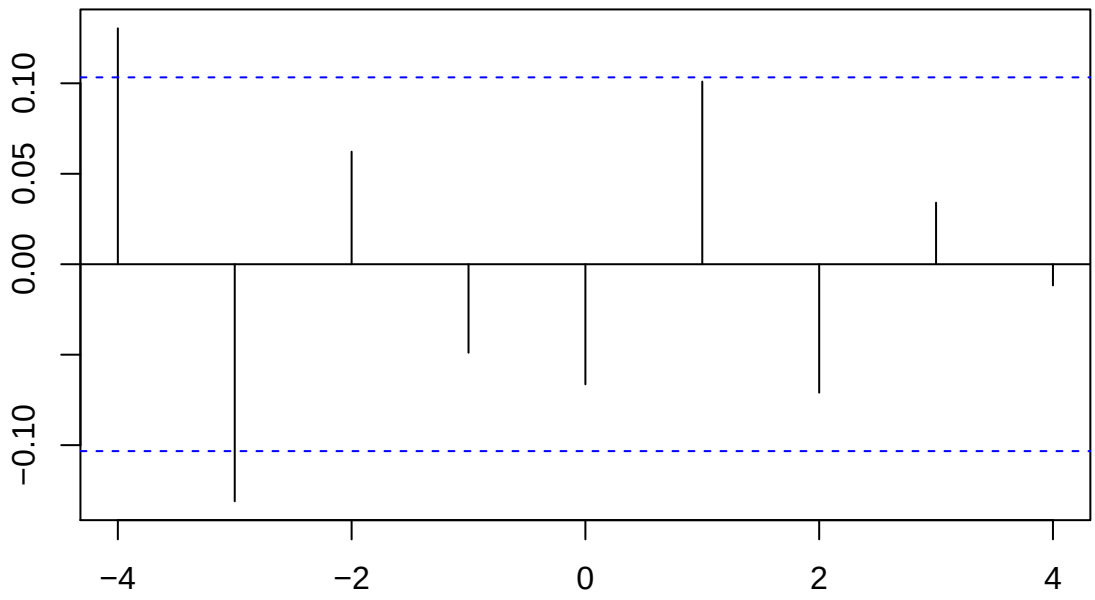
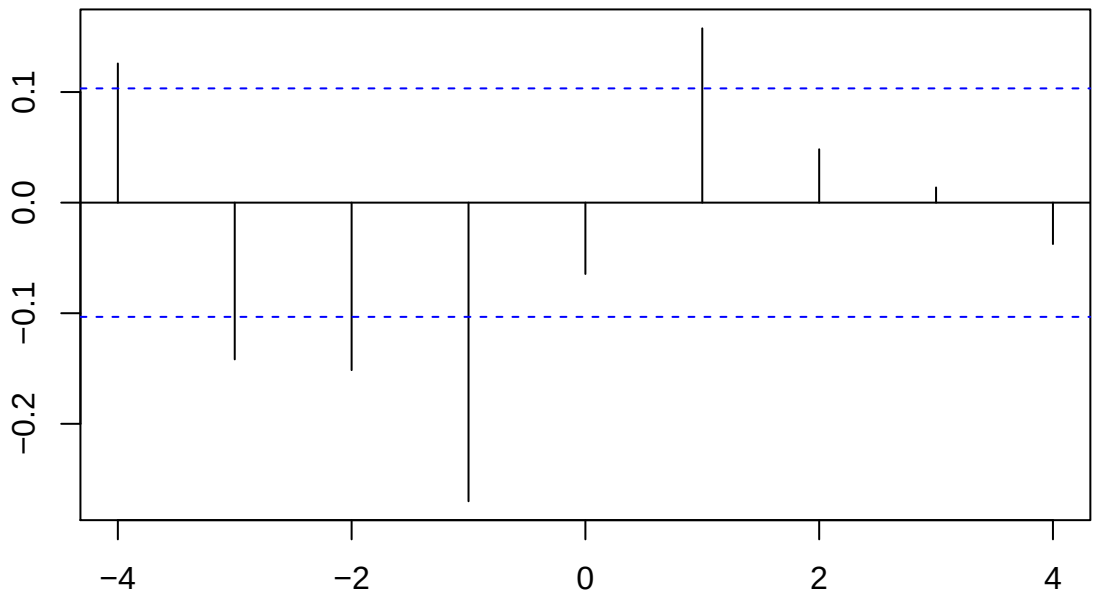
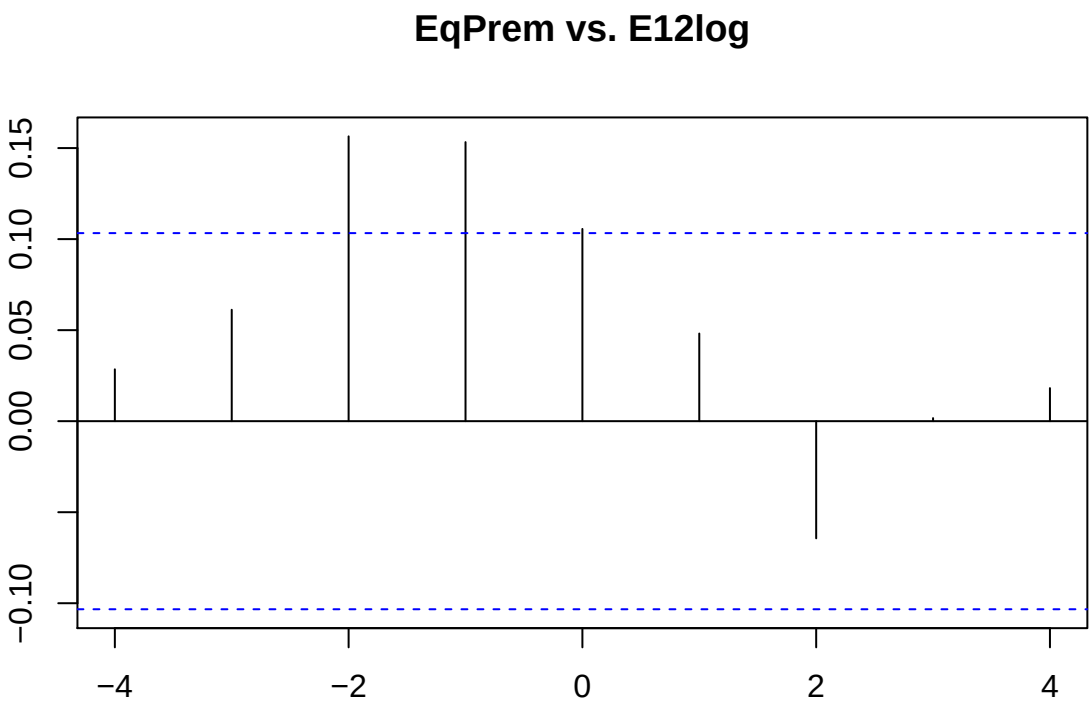
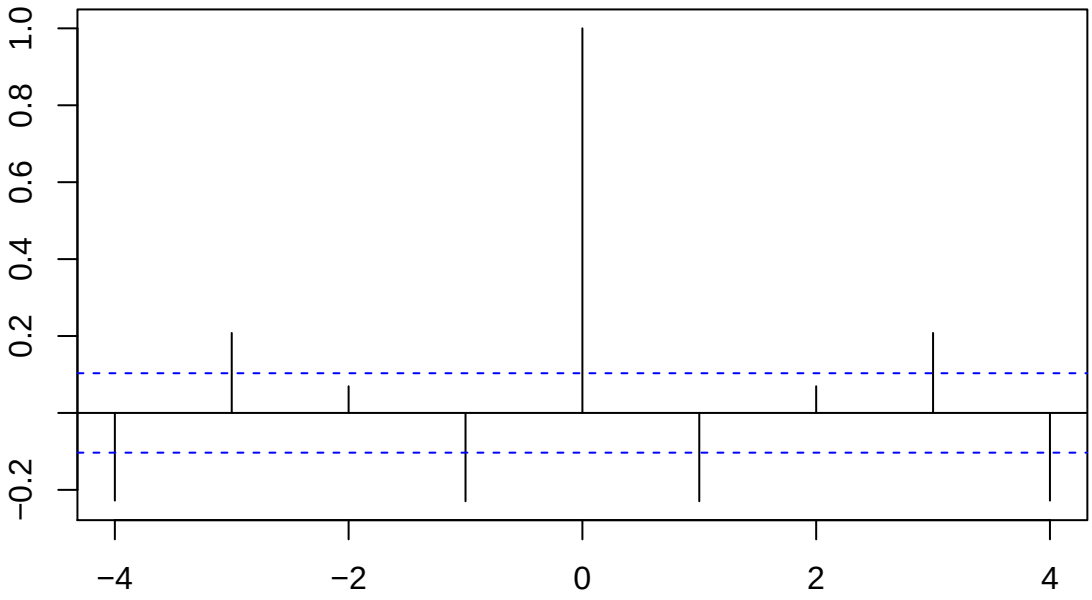

infl vs. E12log
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

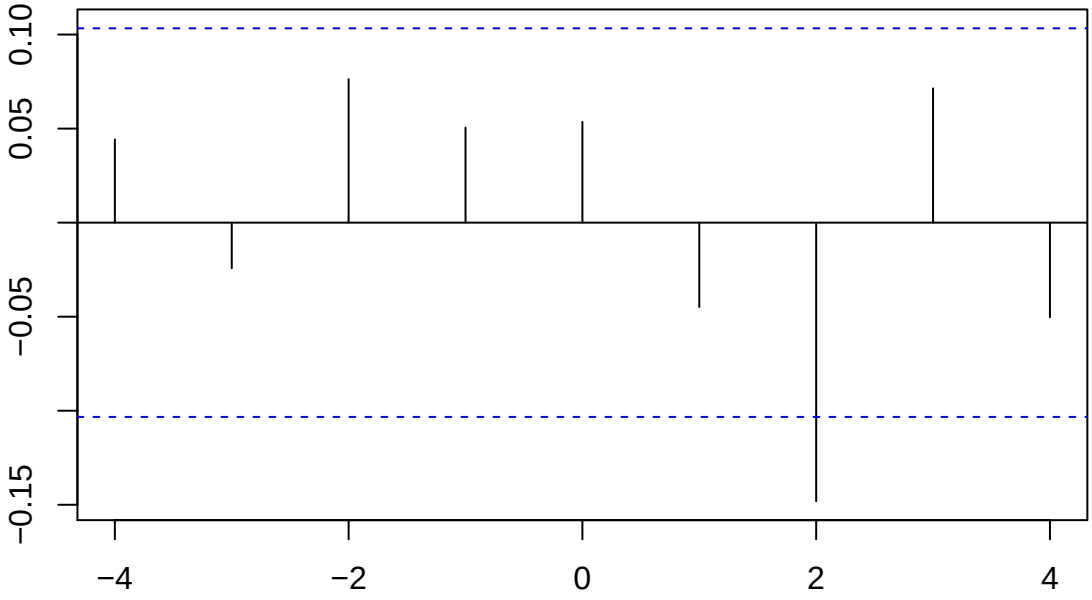

ltr vs. E12log
0.15
0.10
0.05
0.00
−0.10
−4
−2
0
2
4


corpr vs. E12log
0.10
0.05
0.00
−0.10
−4
−2
0
2
4


svar vs. E12log
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4


EqPrem vs. E12log
0.15
0.10
0.05
0.00
−0.10
−4
−2
0
2
4


b.m vs. b.m
1.0
0.8
0.6
0.4
0.2
−0.2
−4
−2
0
2
4


tbl vs. b.m
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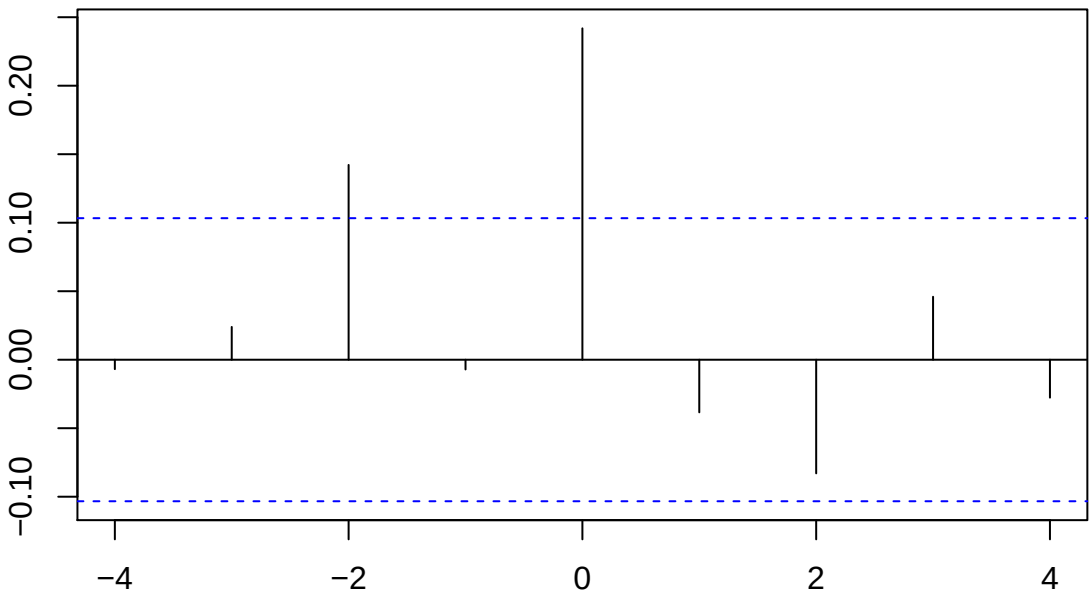
AAA vs. b.m
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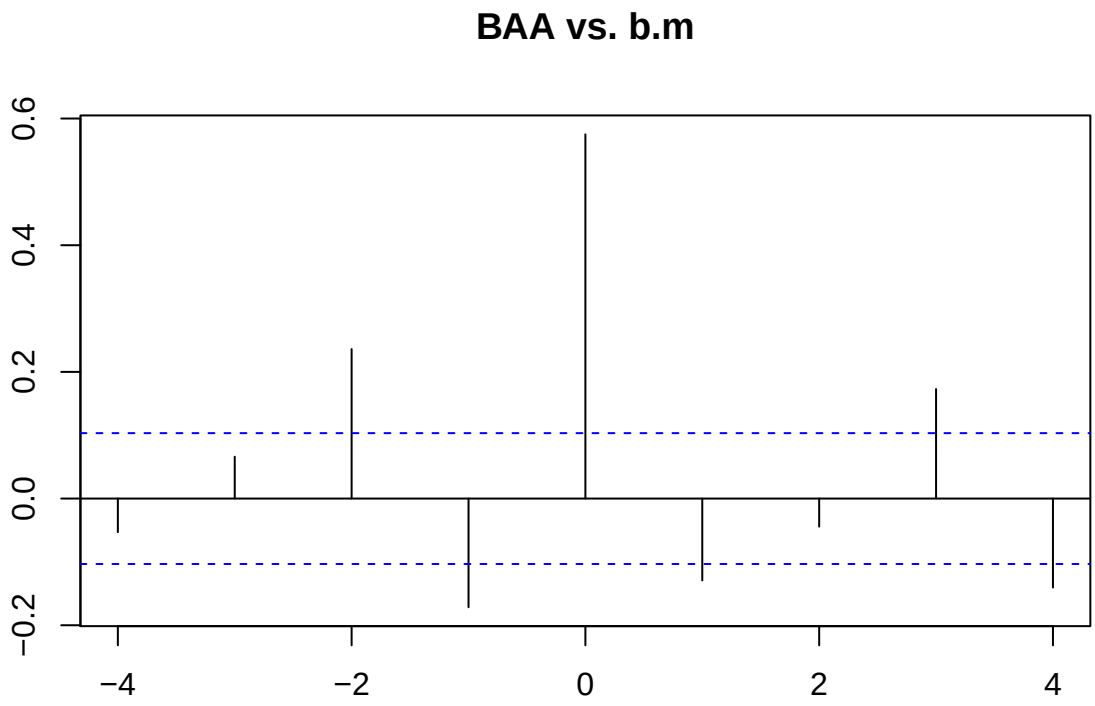
BAA vs. b.m
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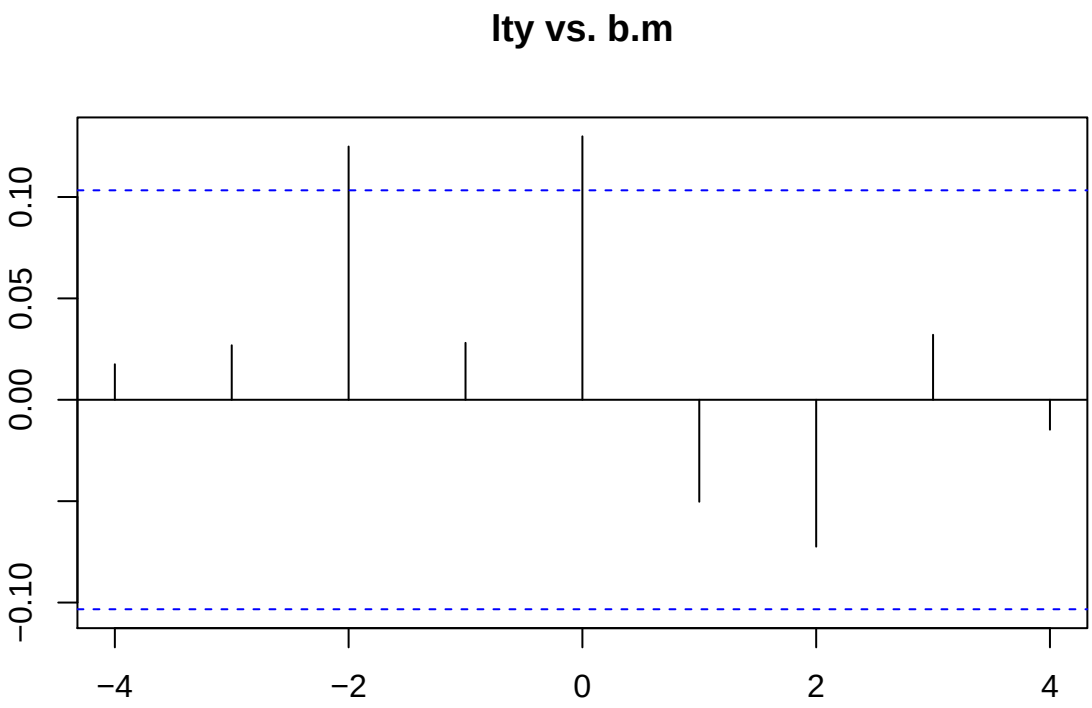
lty vs. b.m
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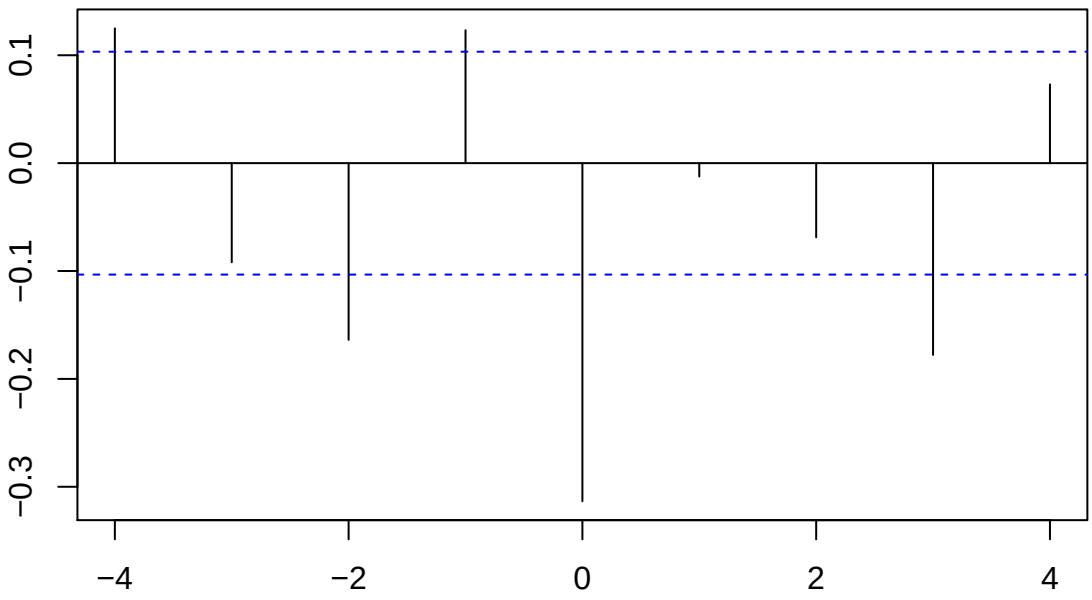
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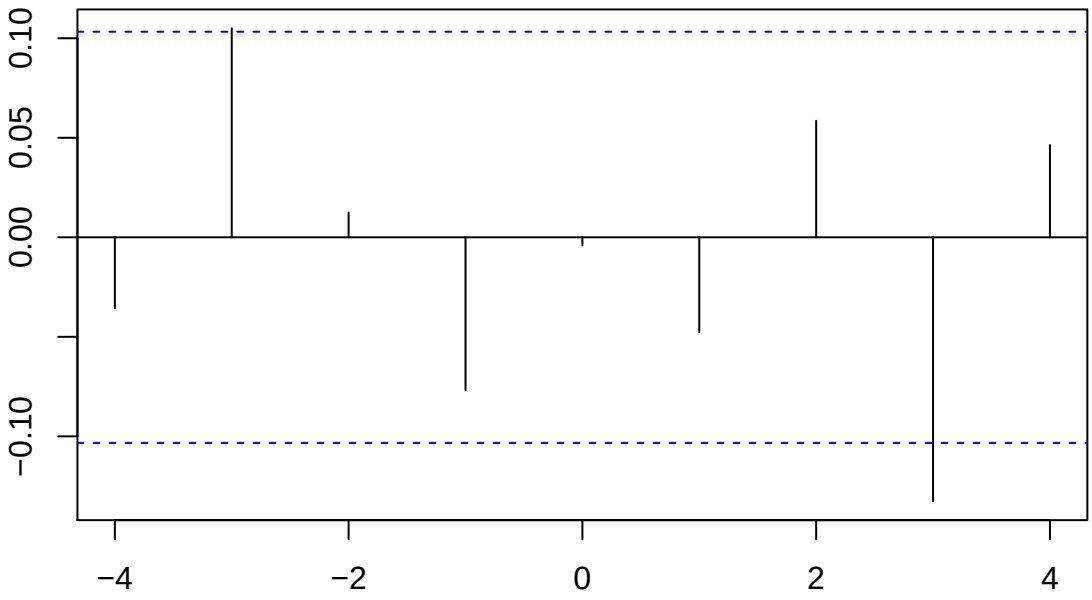
infl vs. b.m
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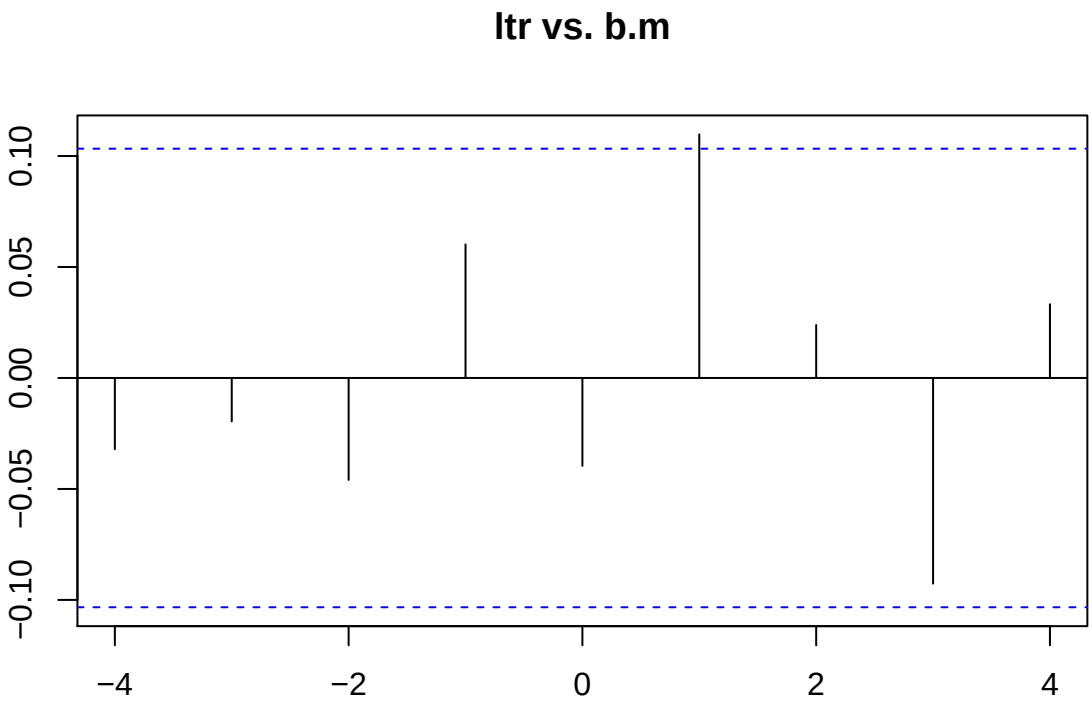
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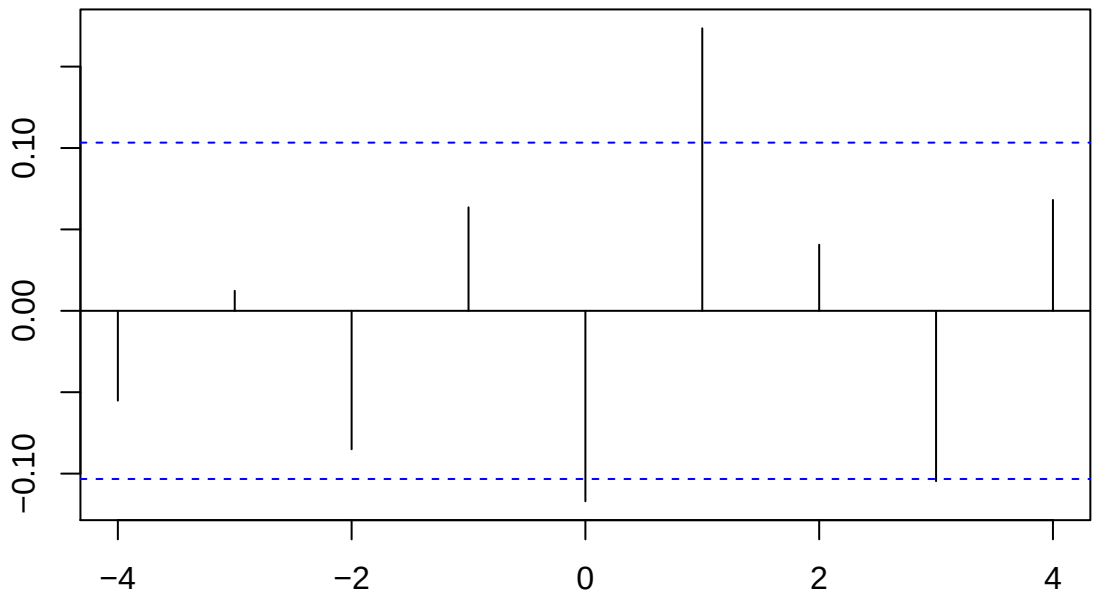
corpr vs. b.m
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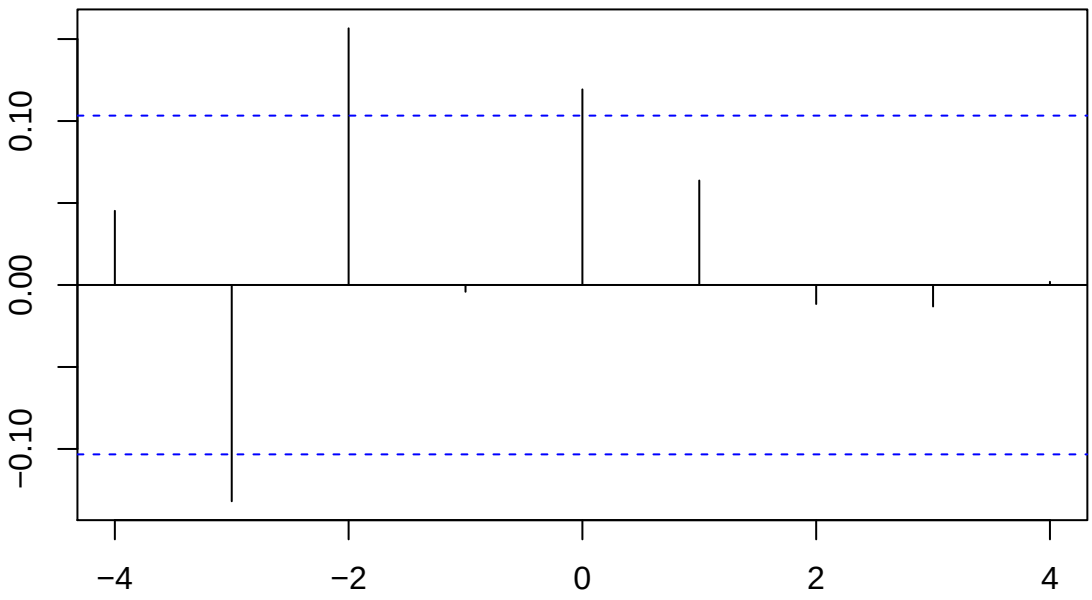
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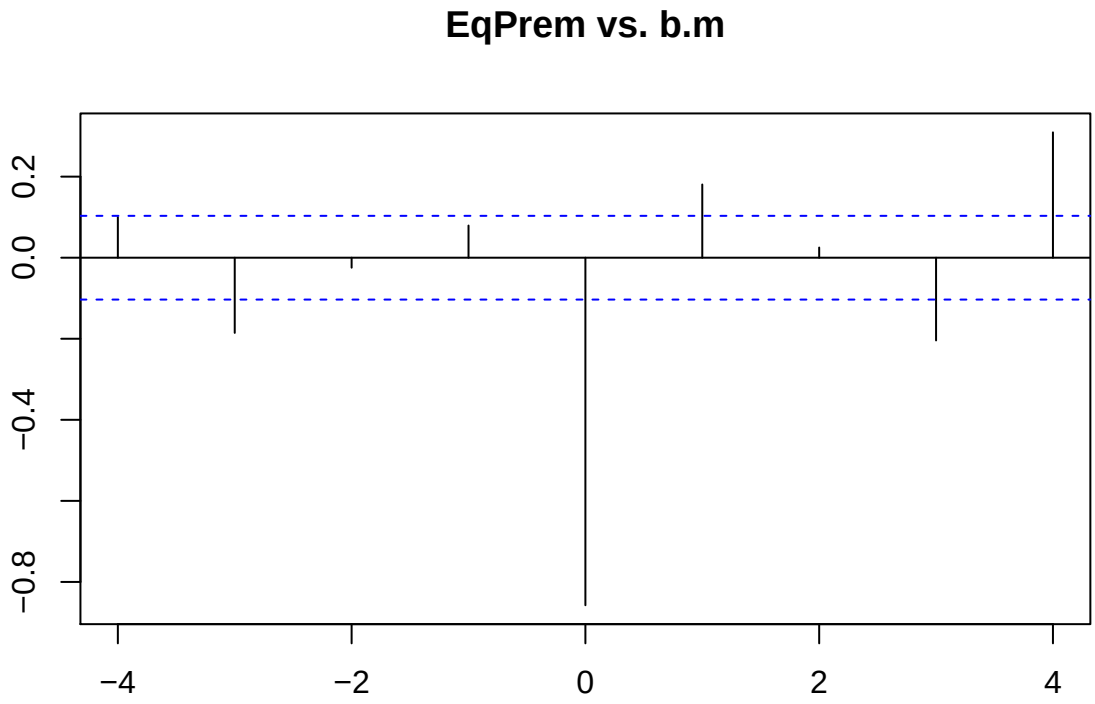
EqPrem vs. b.m
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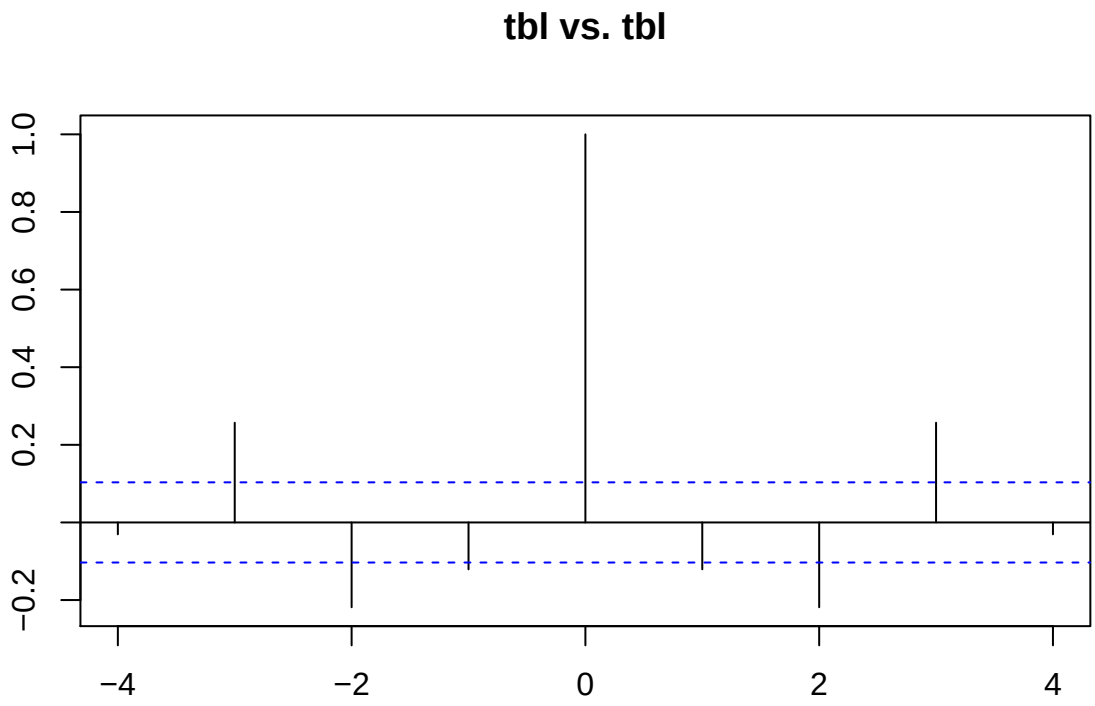
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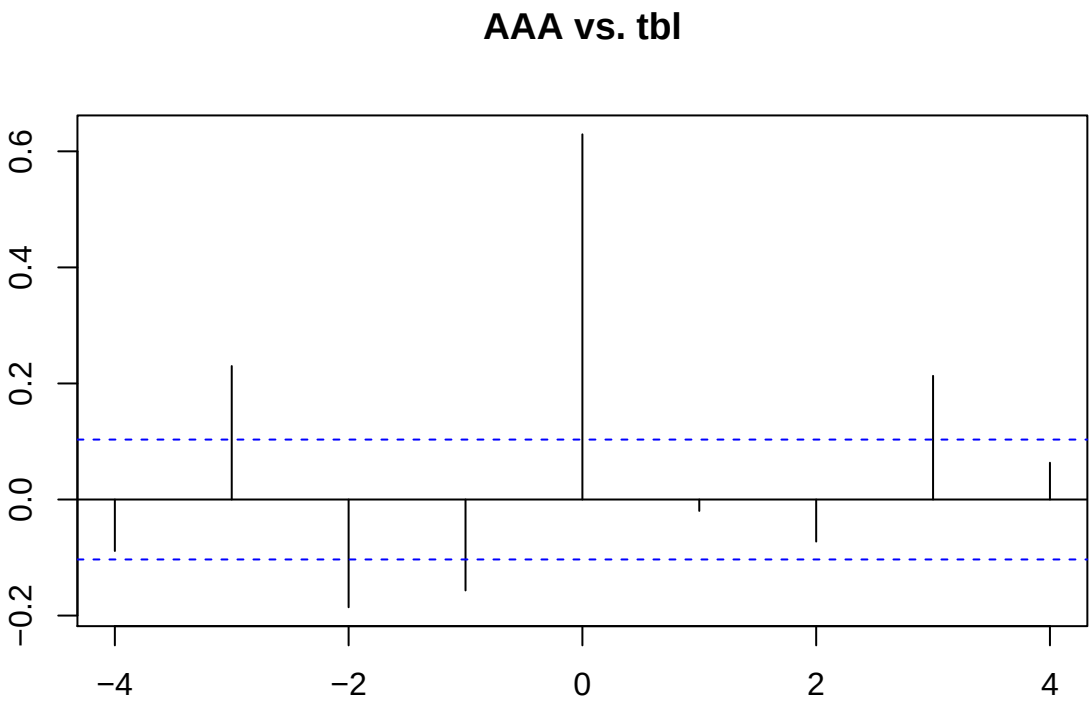
AAA vs. tbl
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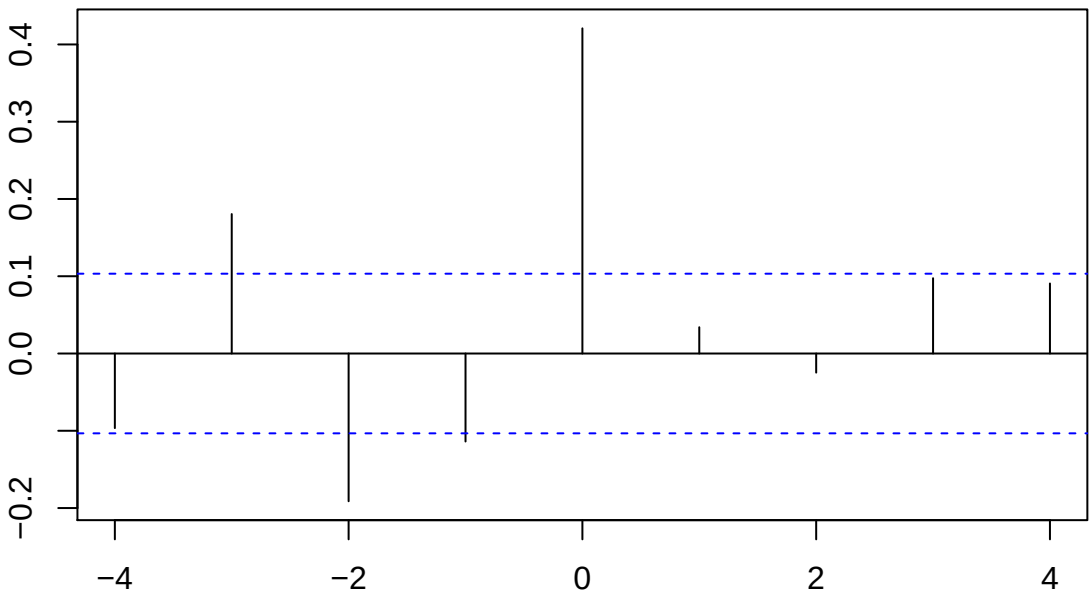
BAA vs. tbl
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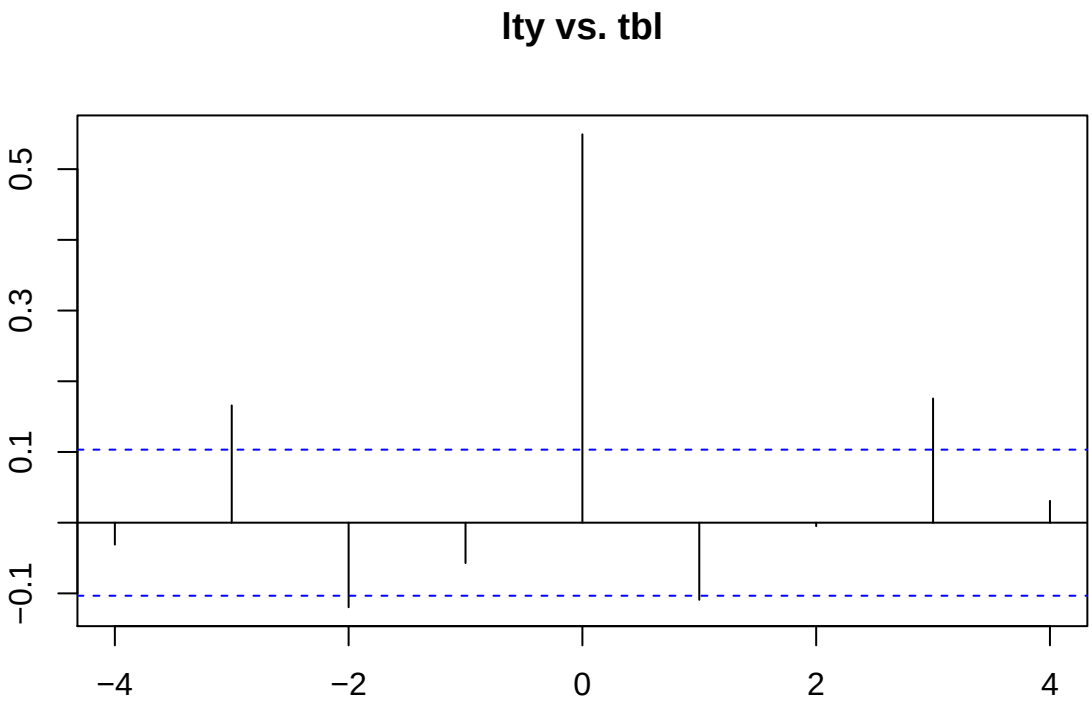
lty vs. tbl
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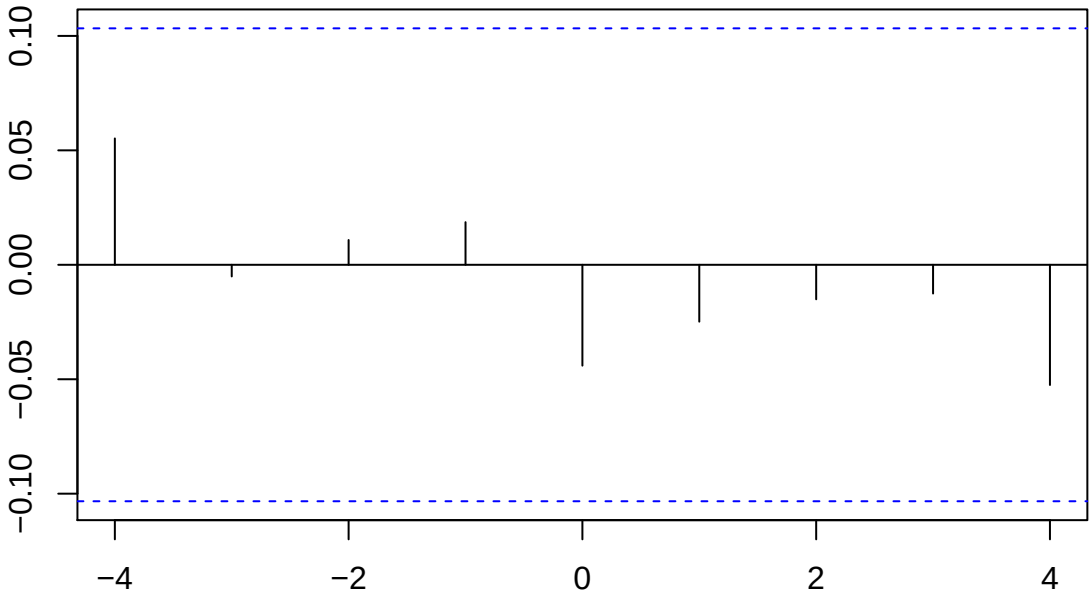
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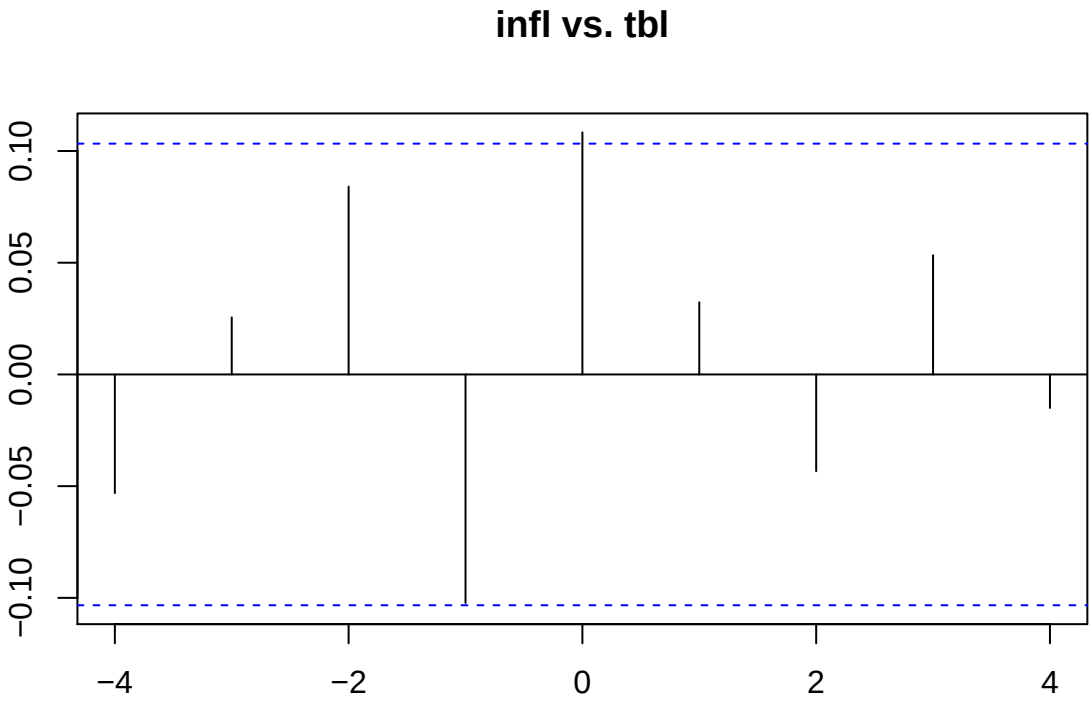
infl vs. tbl
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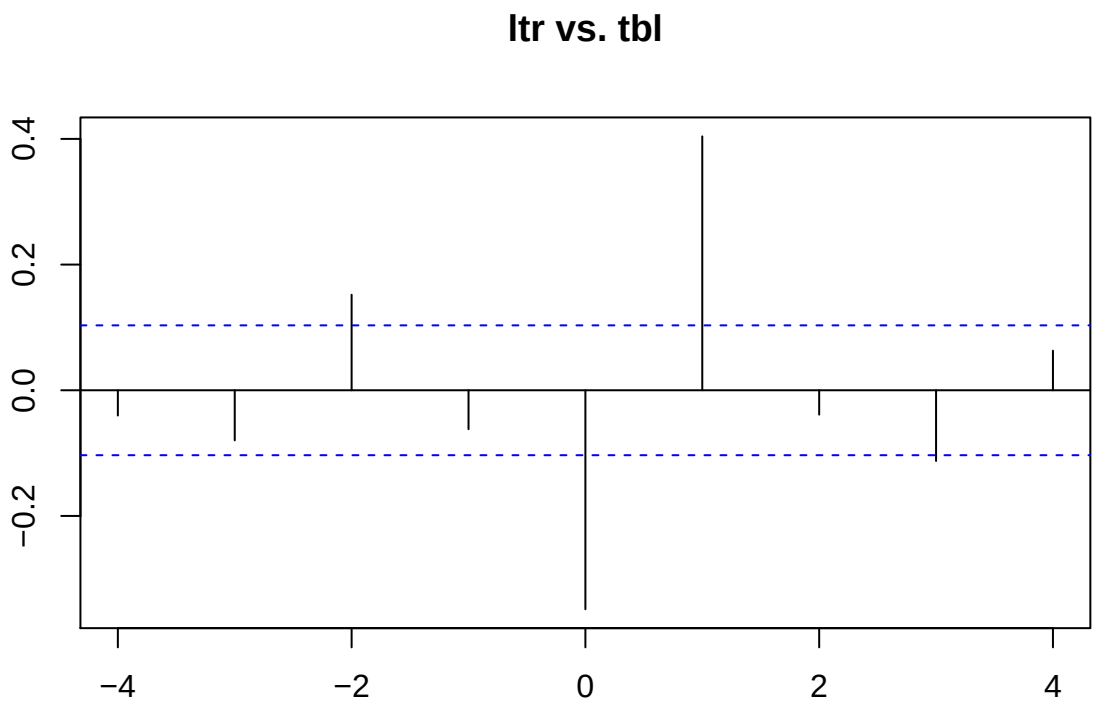
ltr vs. tbl
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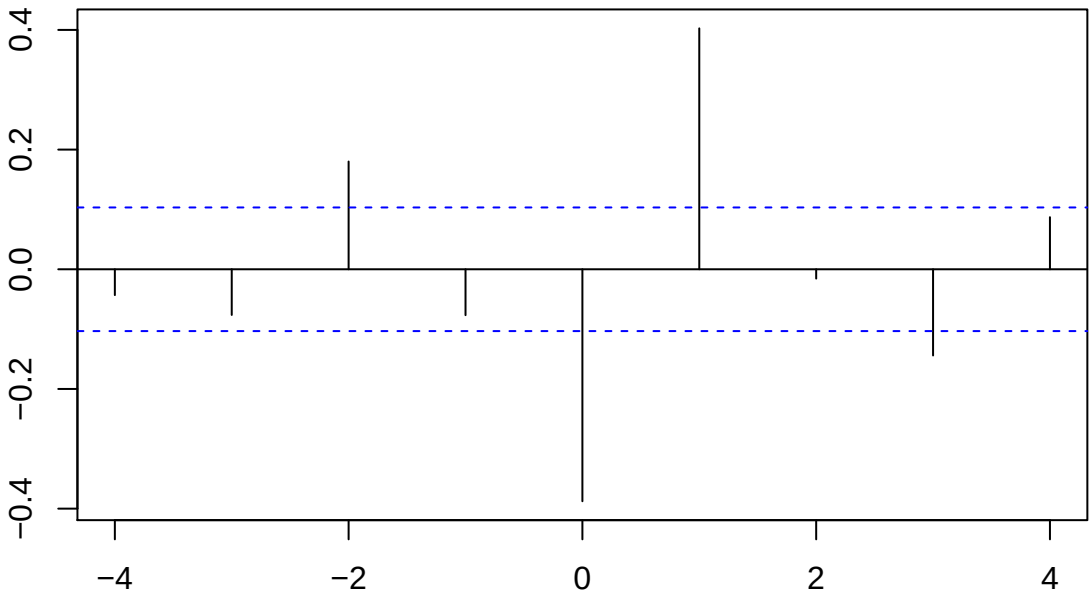
corpr vs. tbl
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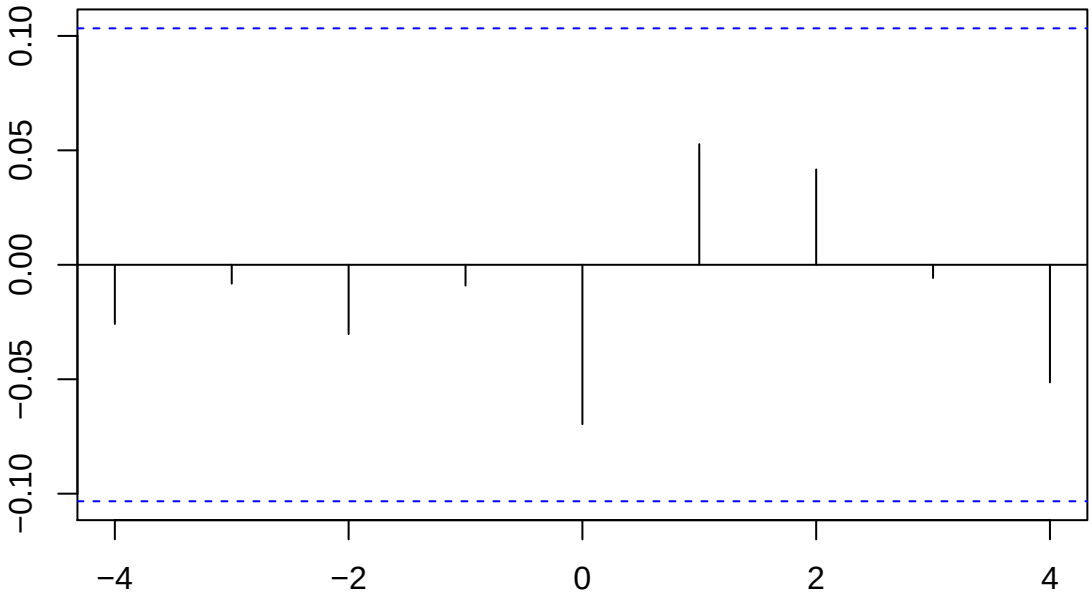
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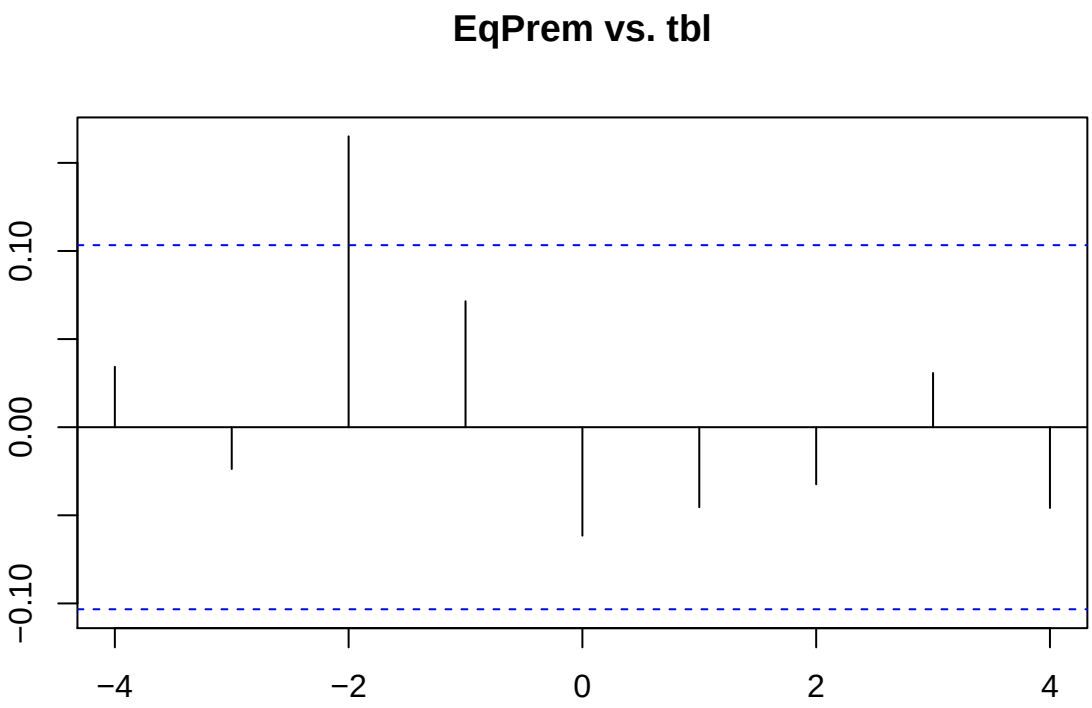
EqPrem vs. tbl
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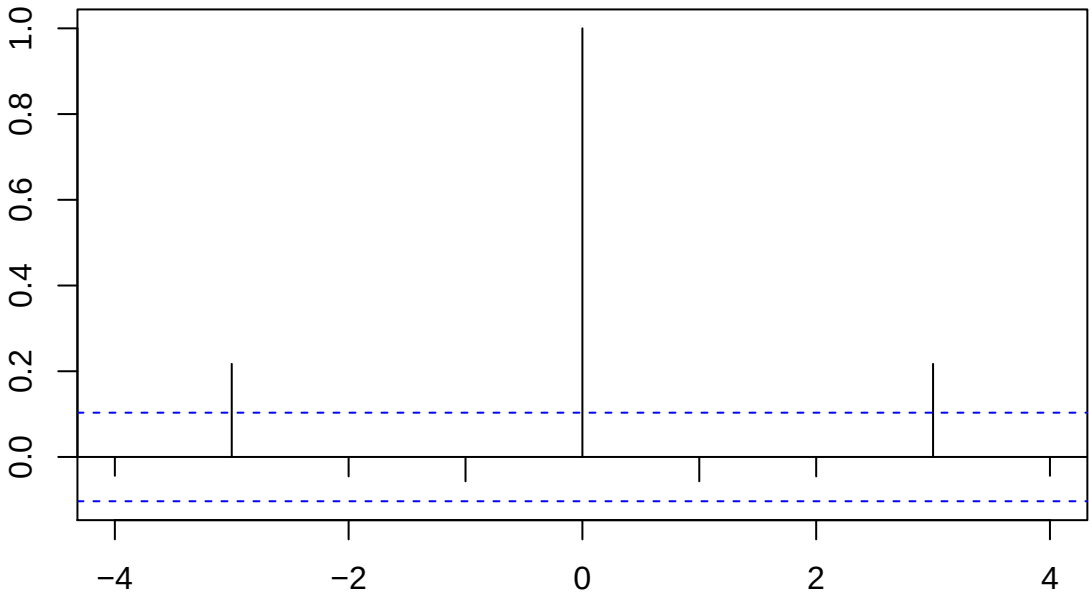
AAA vs. AAA
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−4
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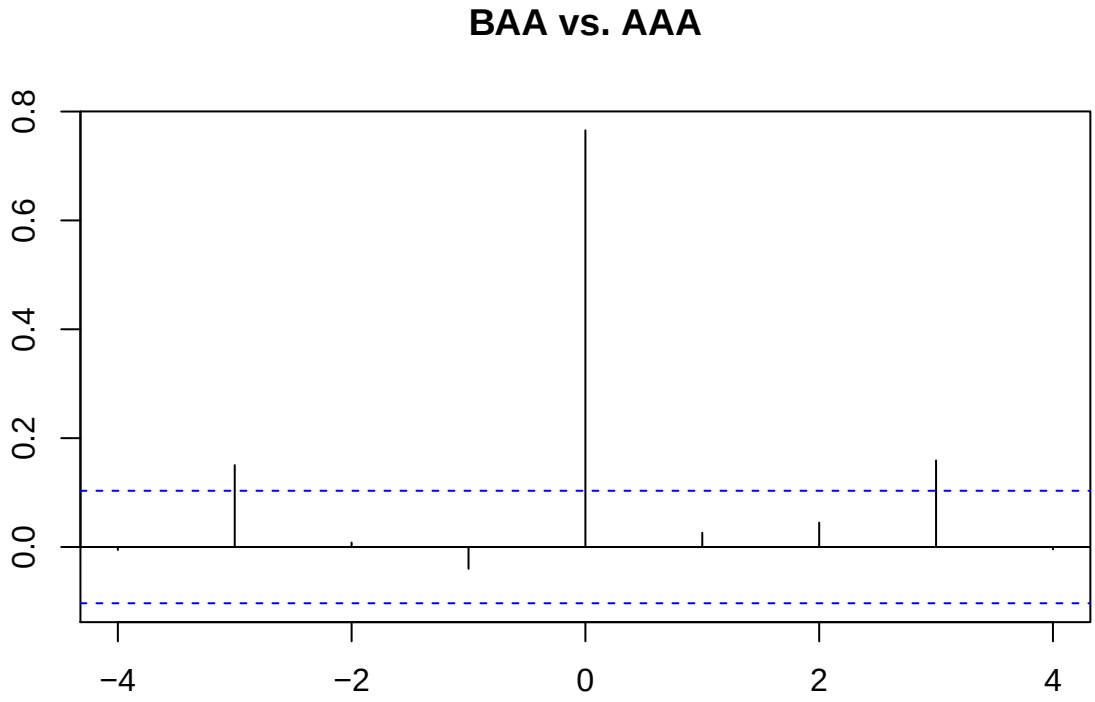
BAA vs. AAA
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0.8
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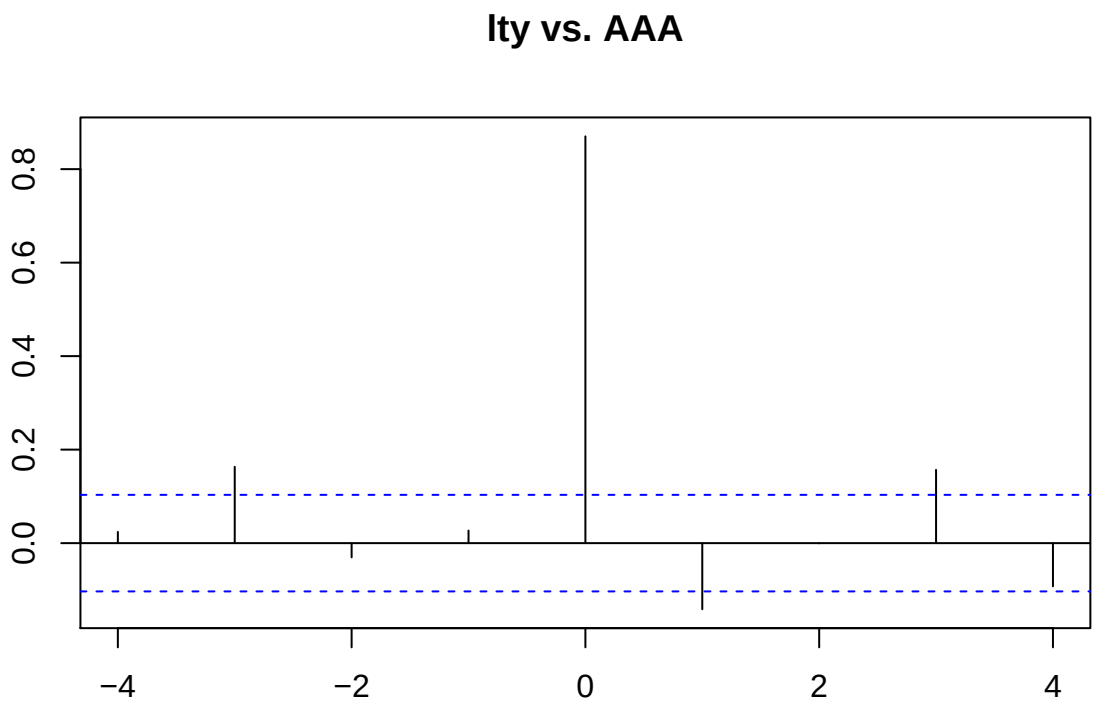
lty vs. AAA
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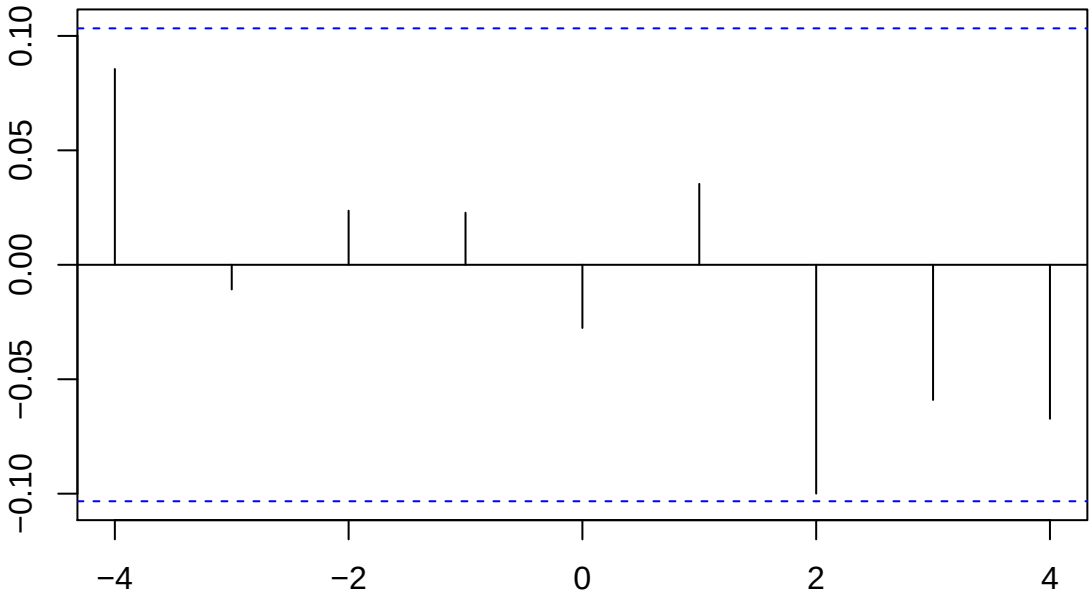
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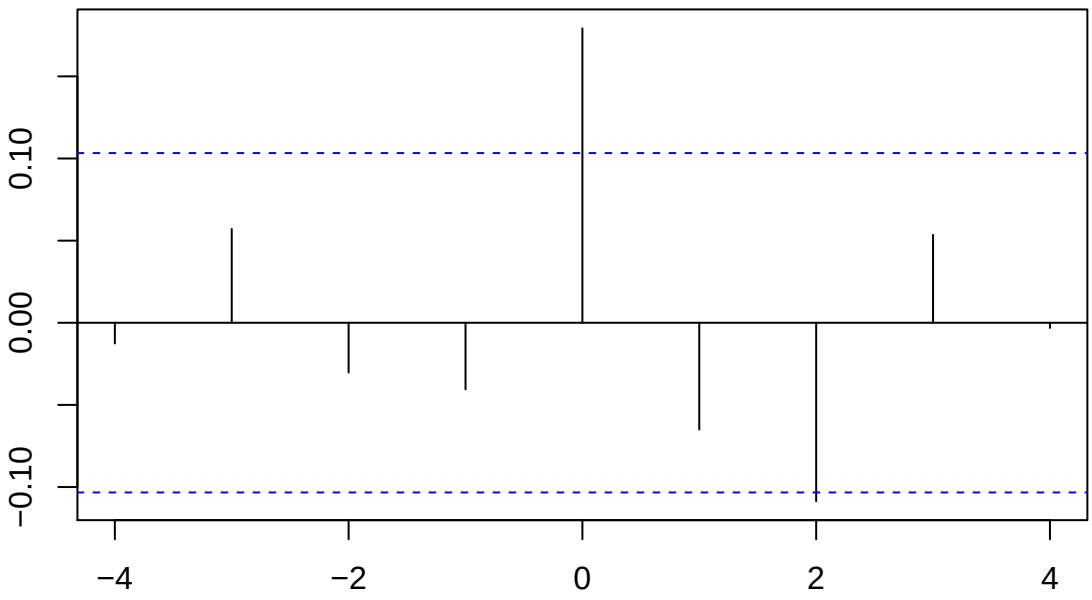
infl vs. AAA
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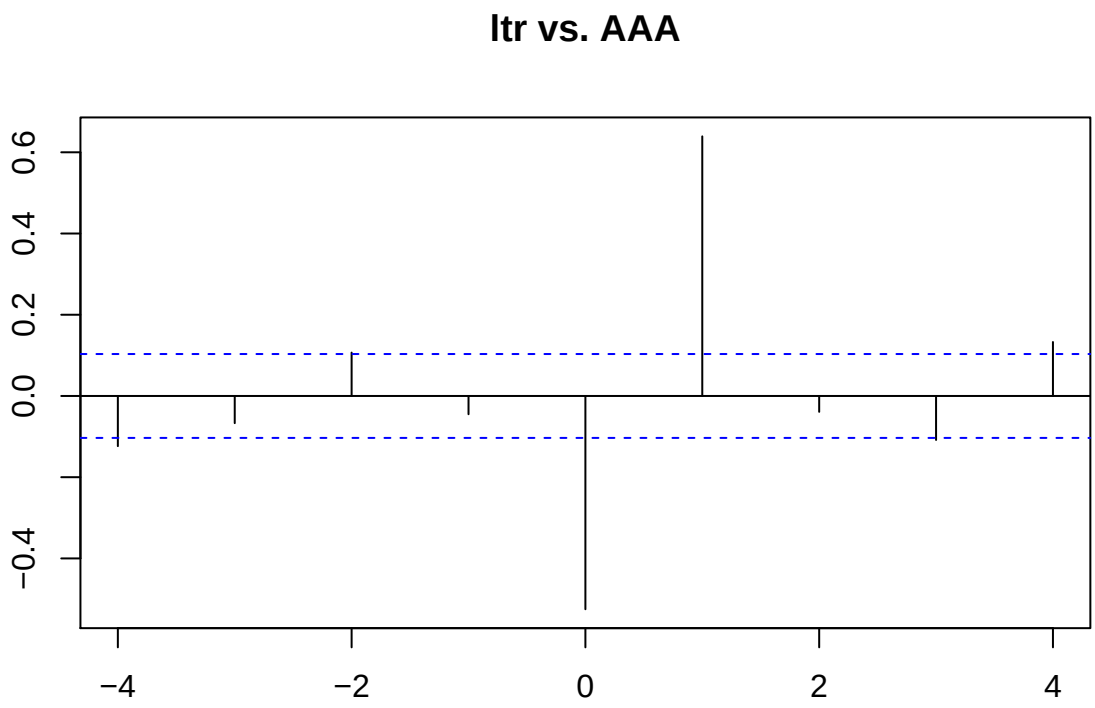
ltr vs. AAA
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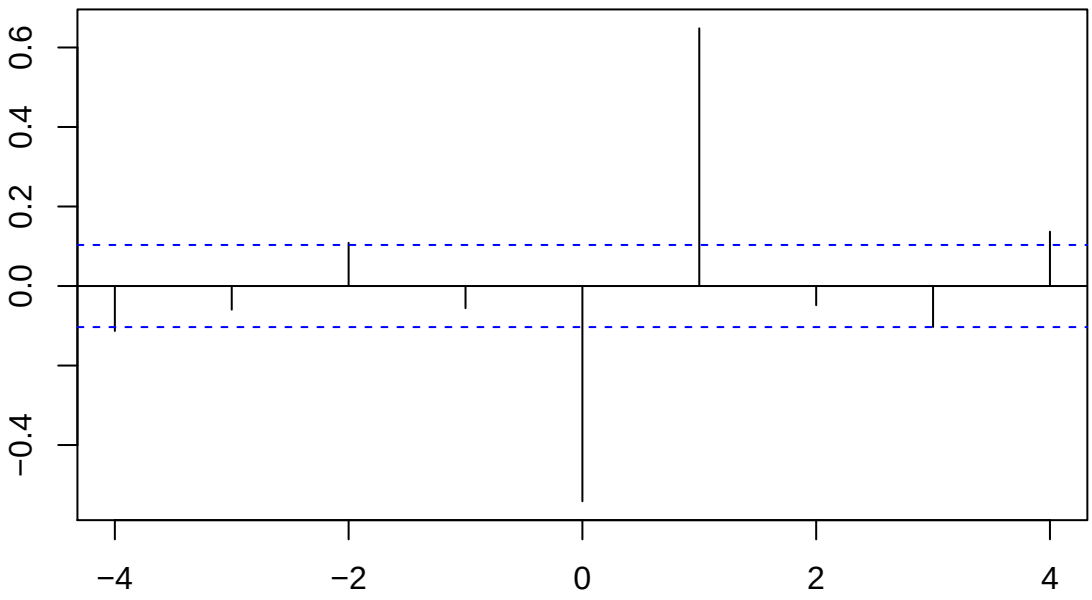
corpr vs. AAA
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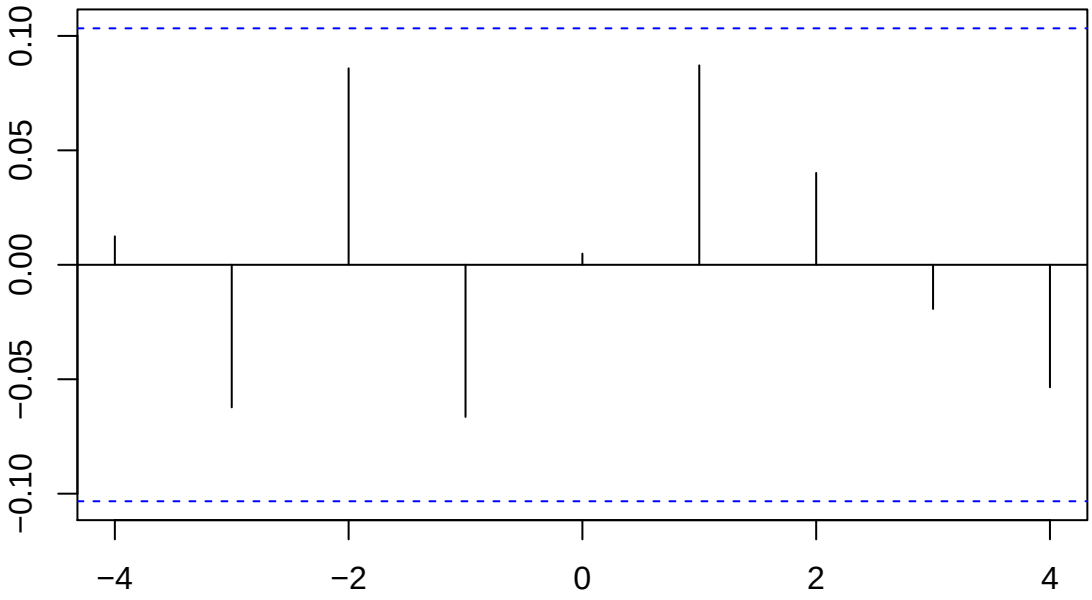
svar vs. AAA
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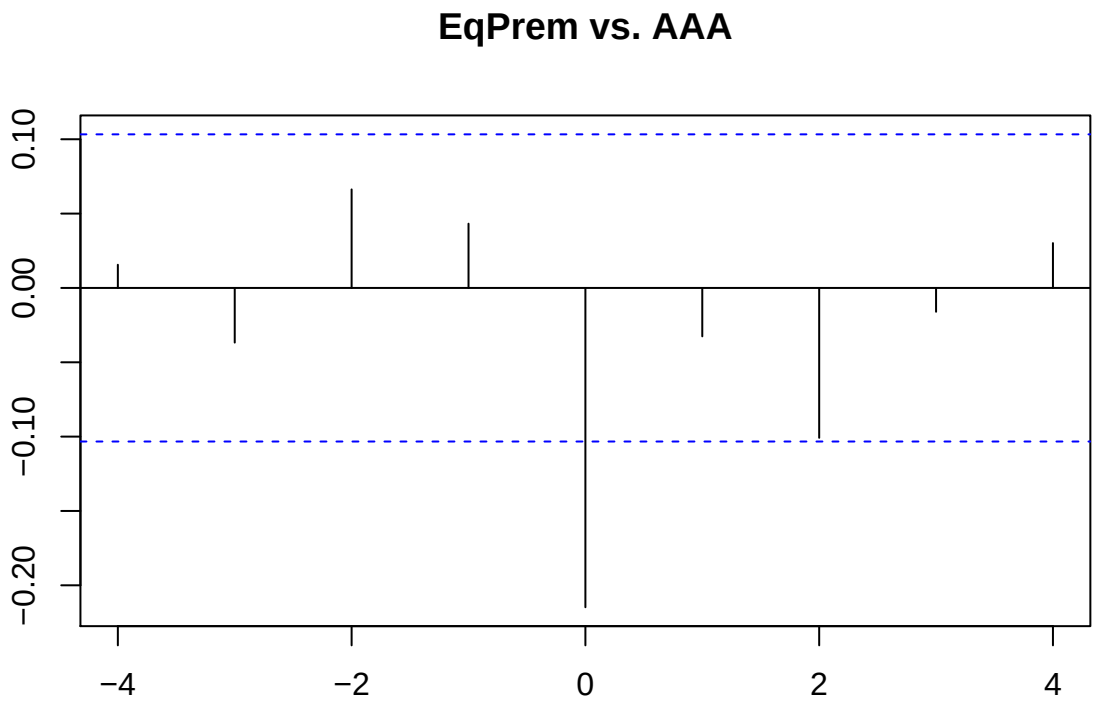
EqPrem vs. AAA
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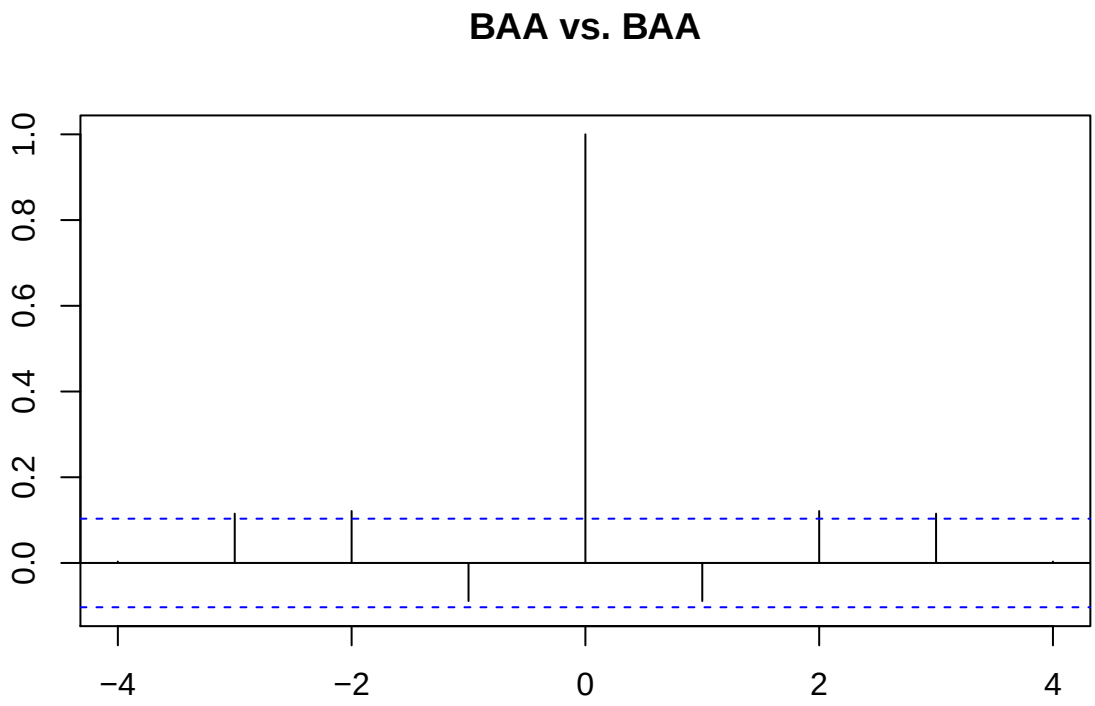
BAA vs. BAA
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2
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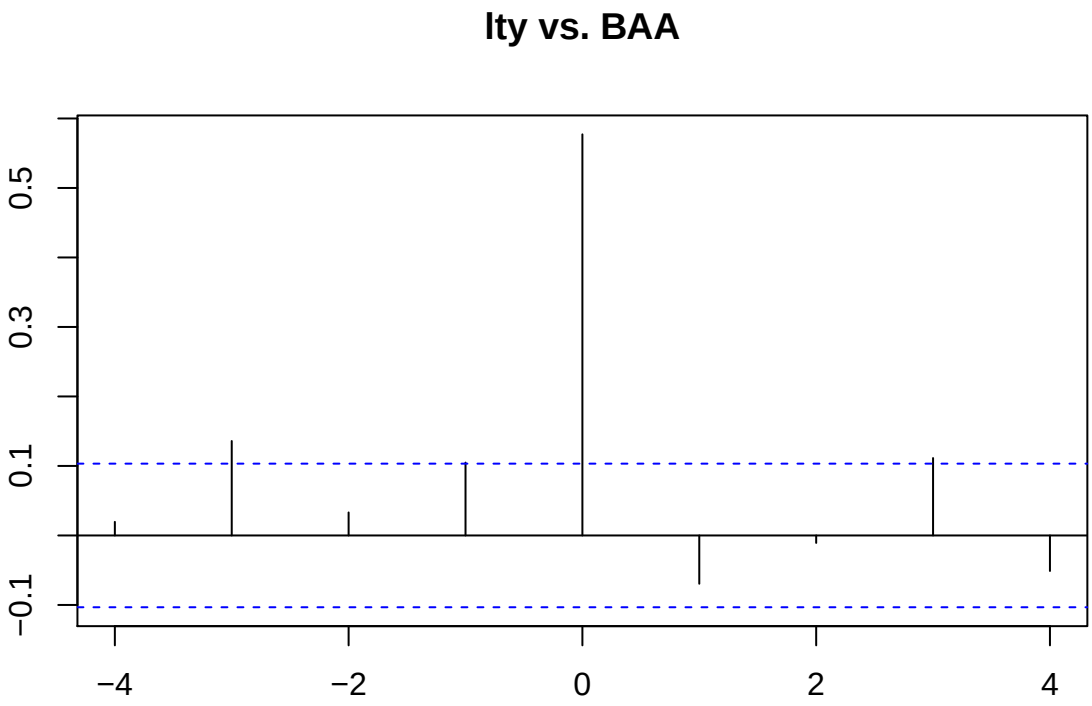
lty vs. BAA
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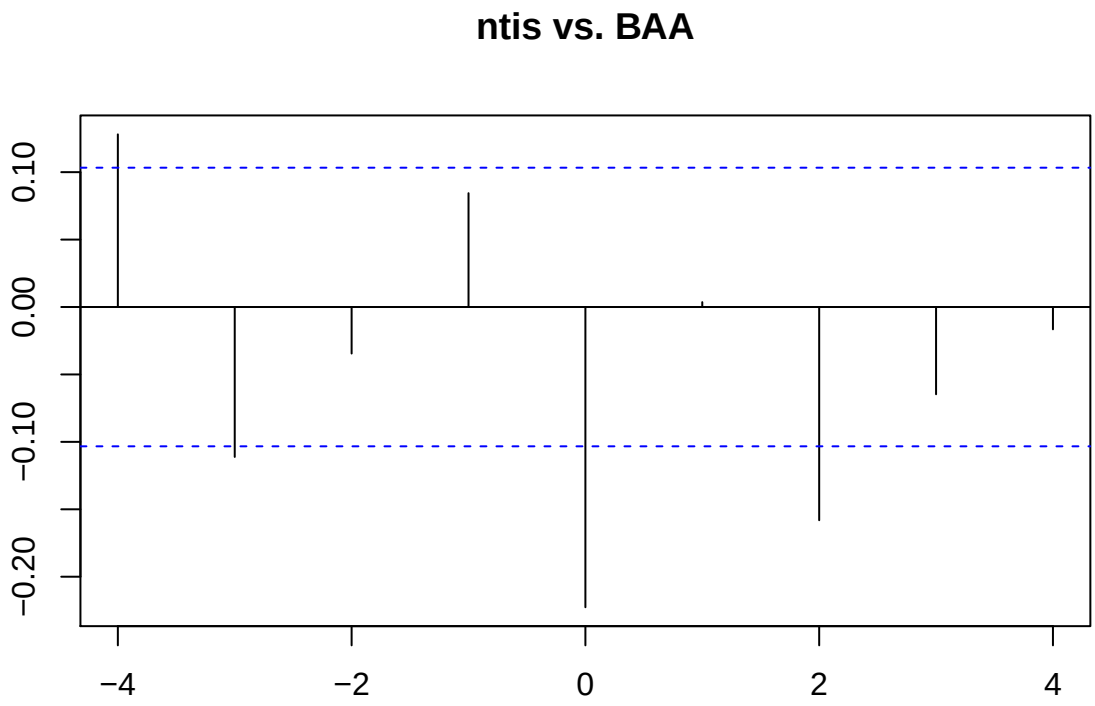
ntis vs. BAA
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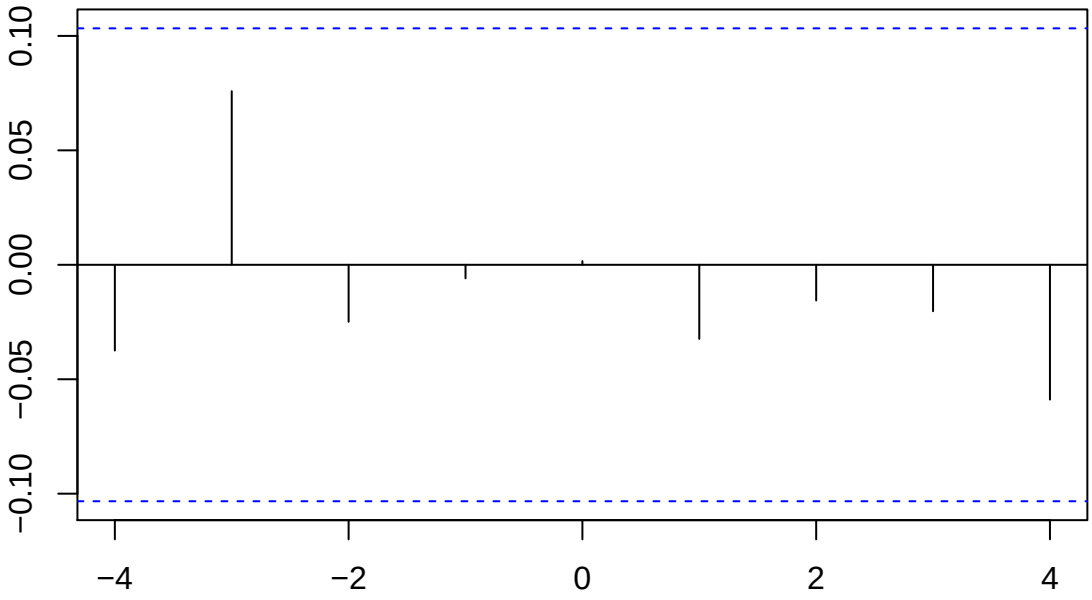
infl vs. BAA
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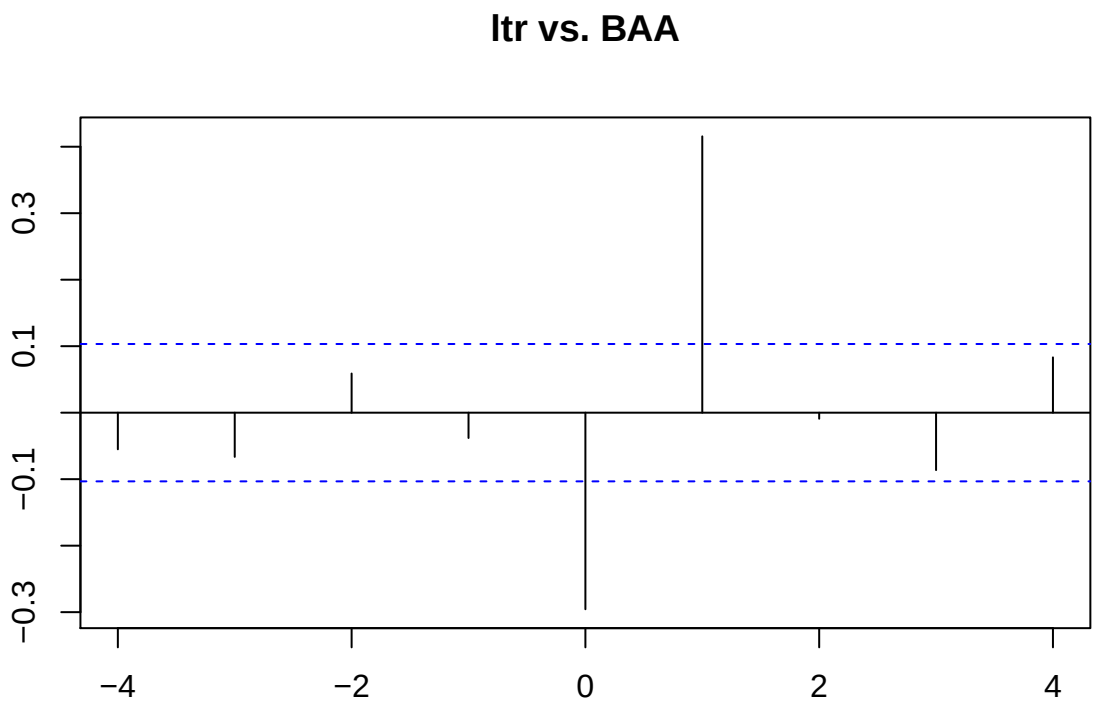
ltr vs. BAA
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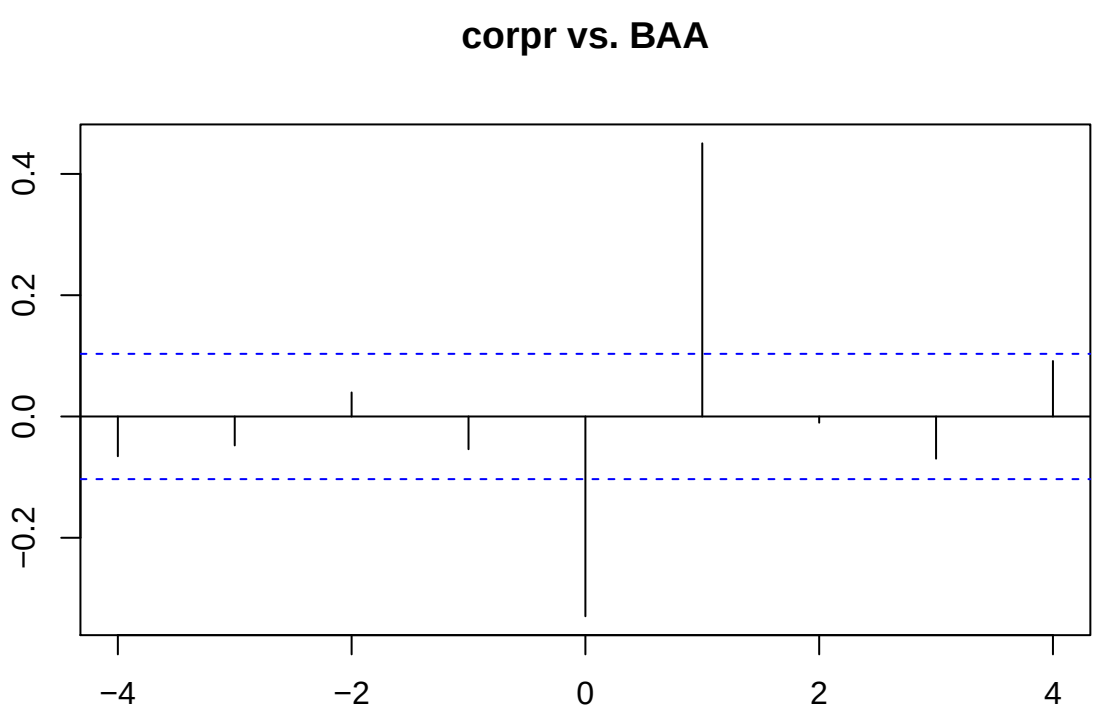
corpr vs. BAA
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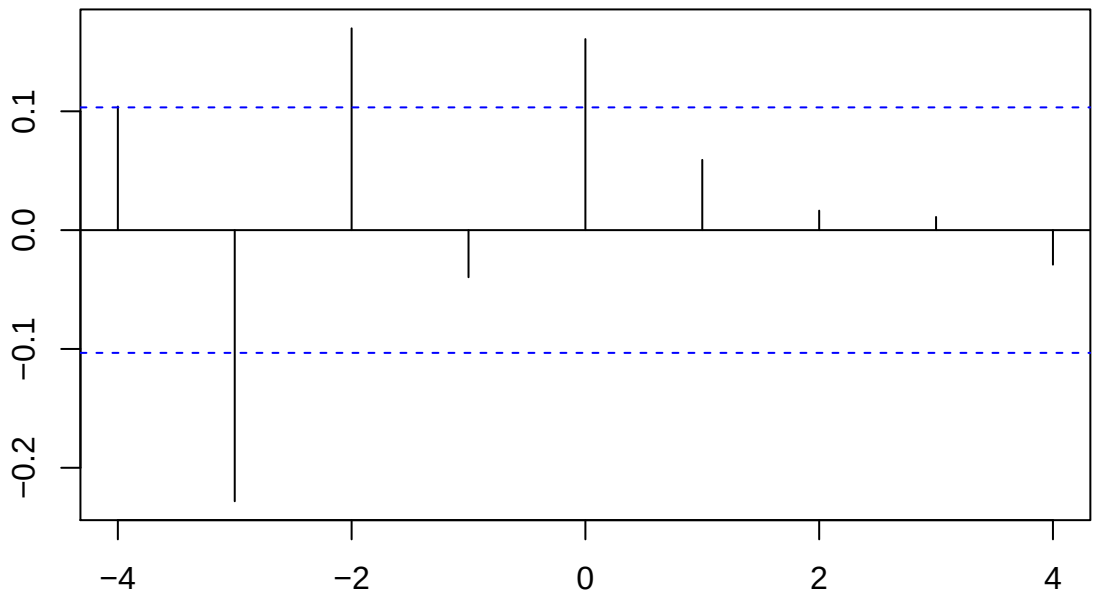
svar vs. BAA
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0.0
−0.1
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−2
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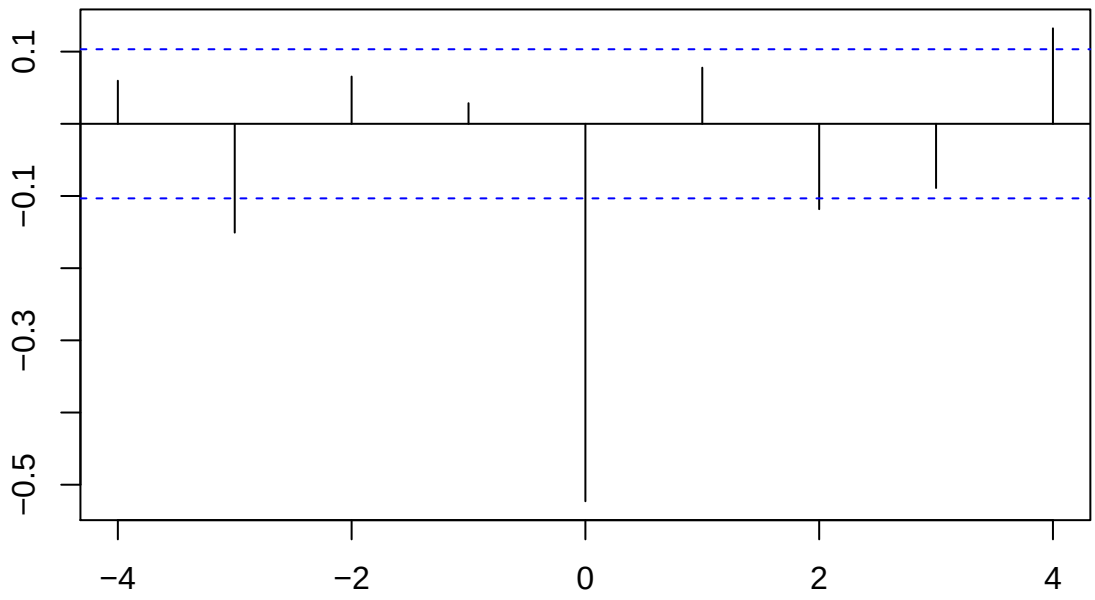
2
4


EqPrem vs. BAA
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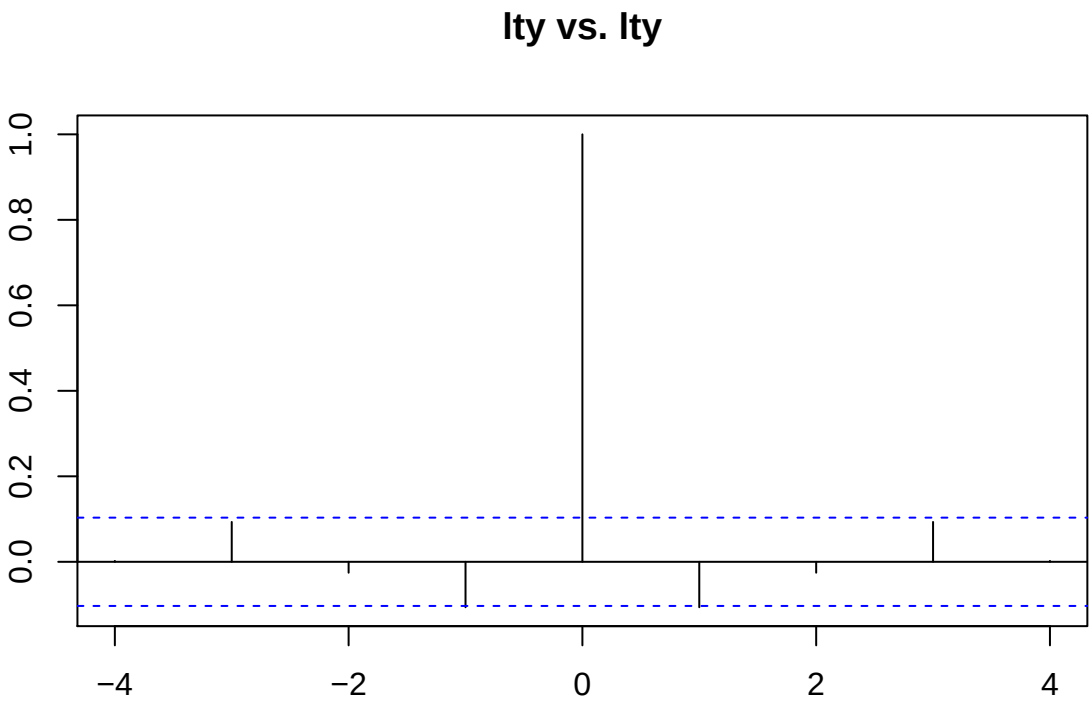
lty vs. lty
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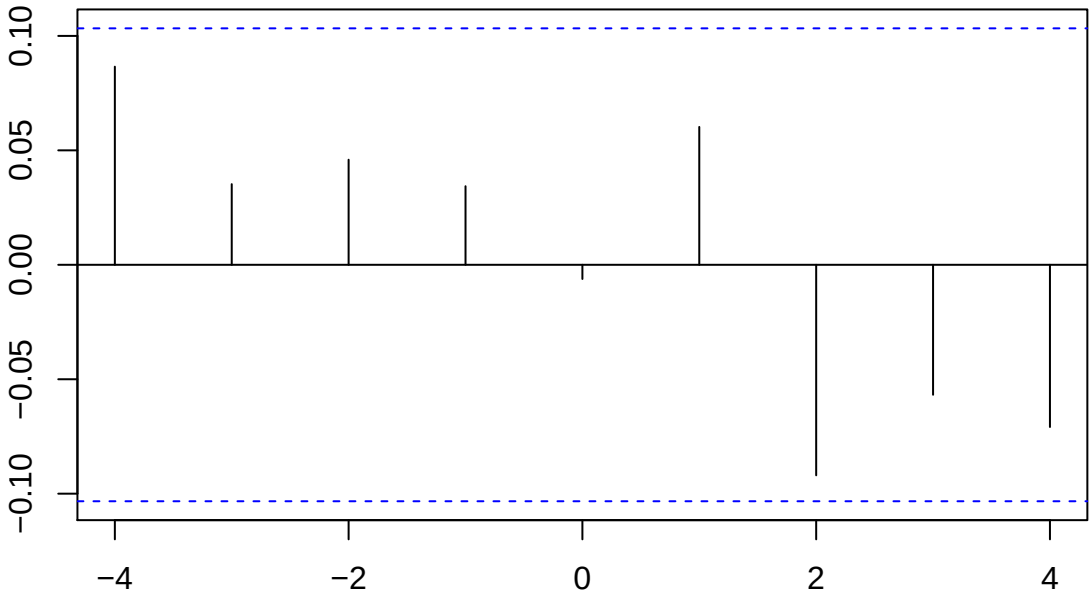
ntis vs. lty
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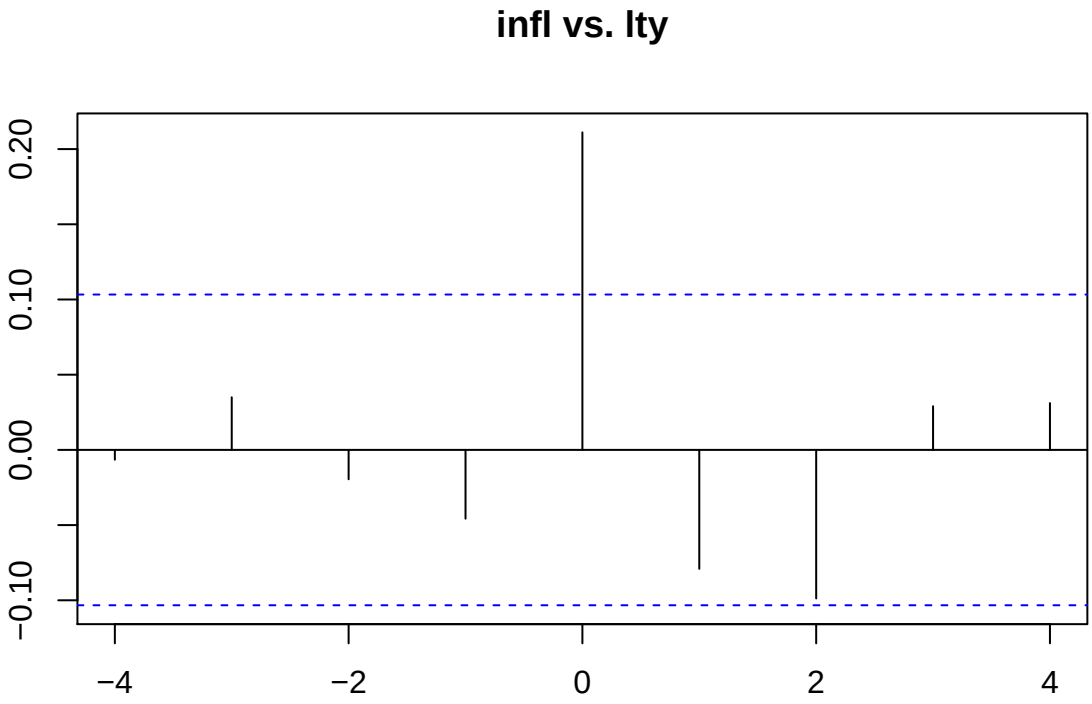
infl vs. lty
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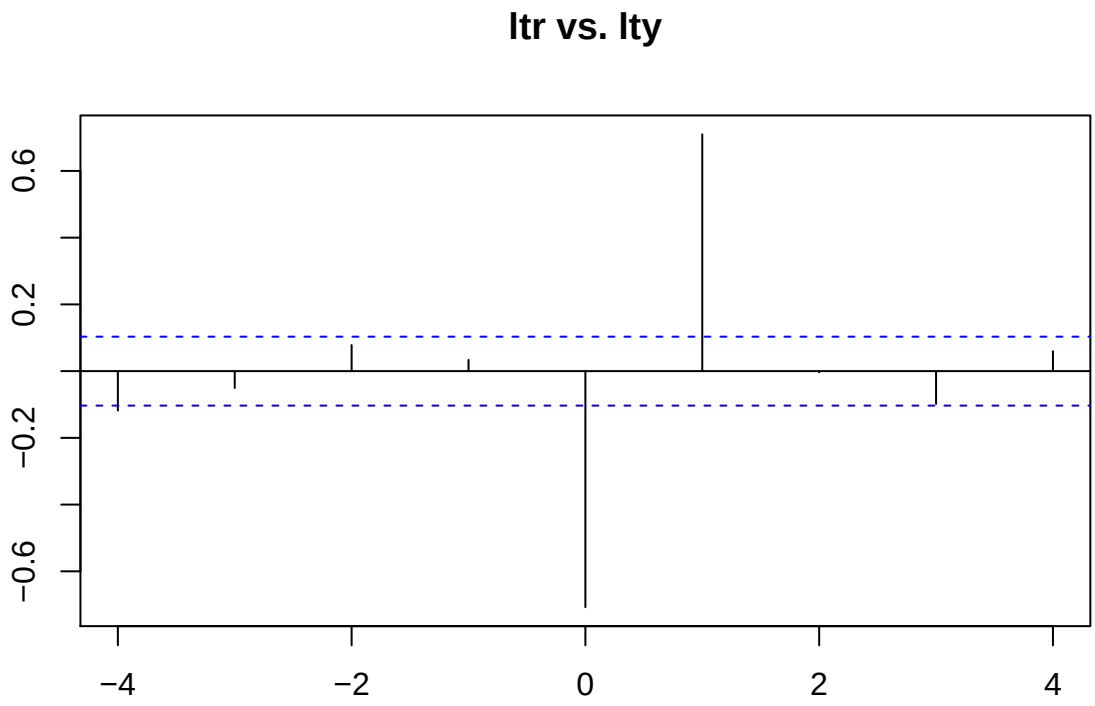
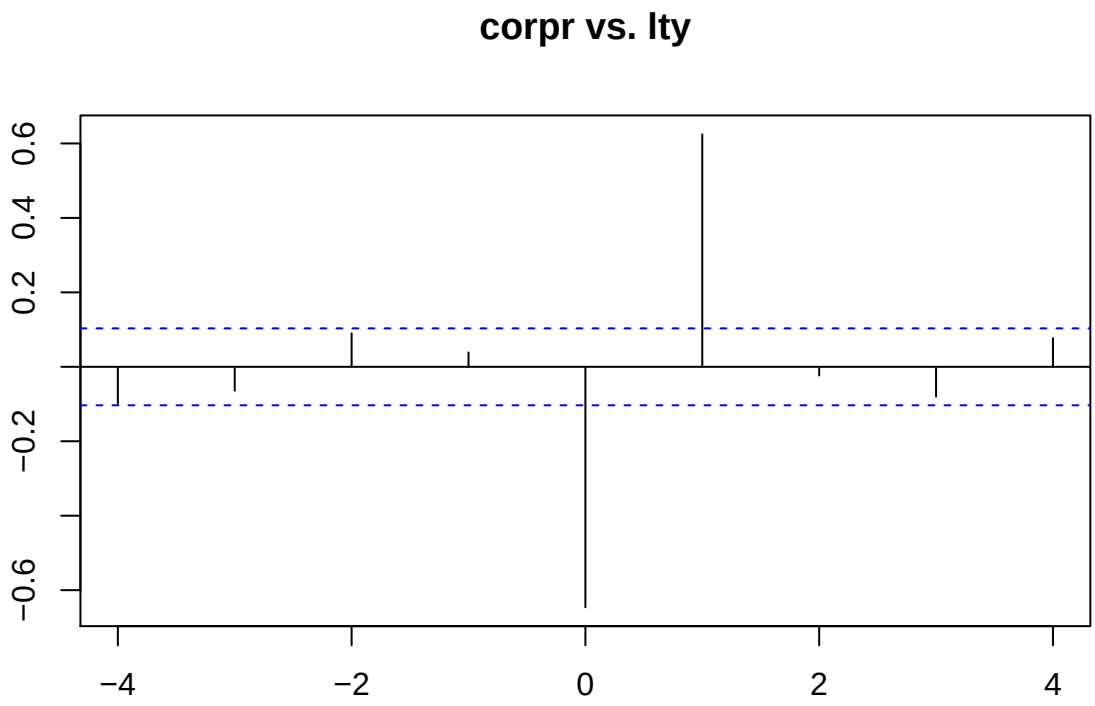
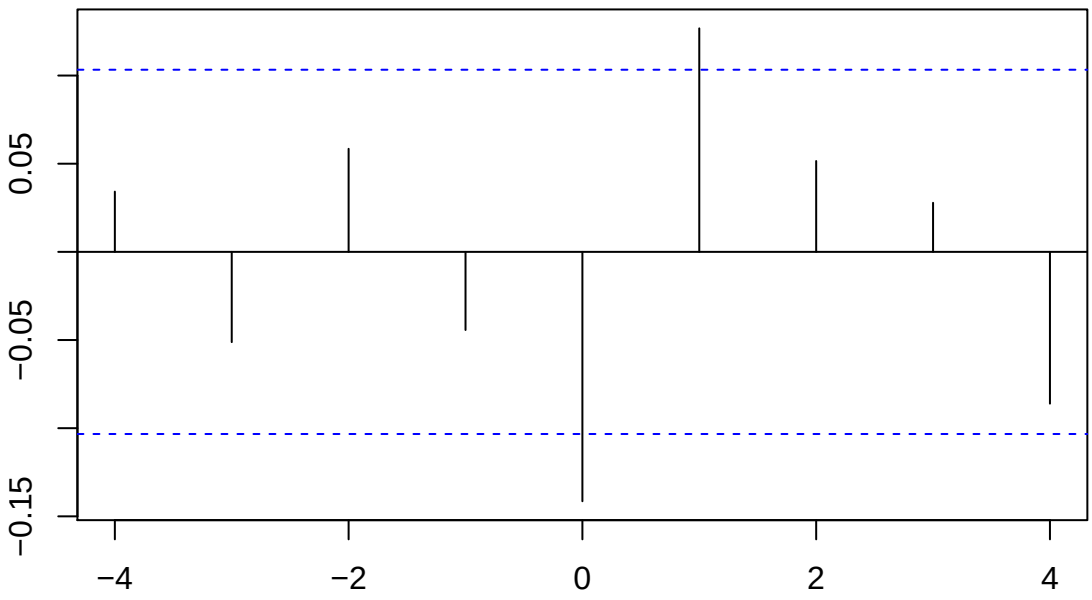
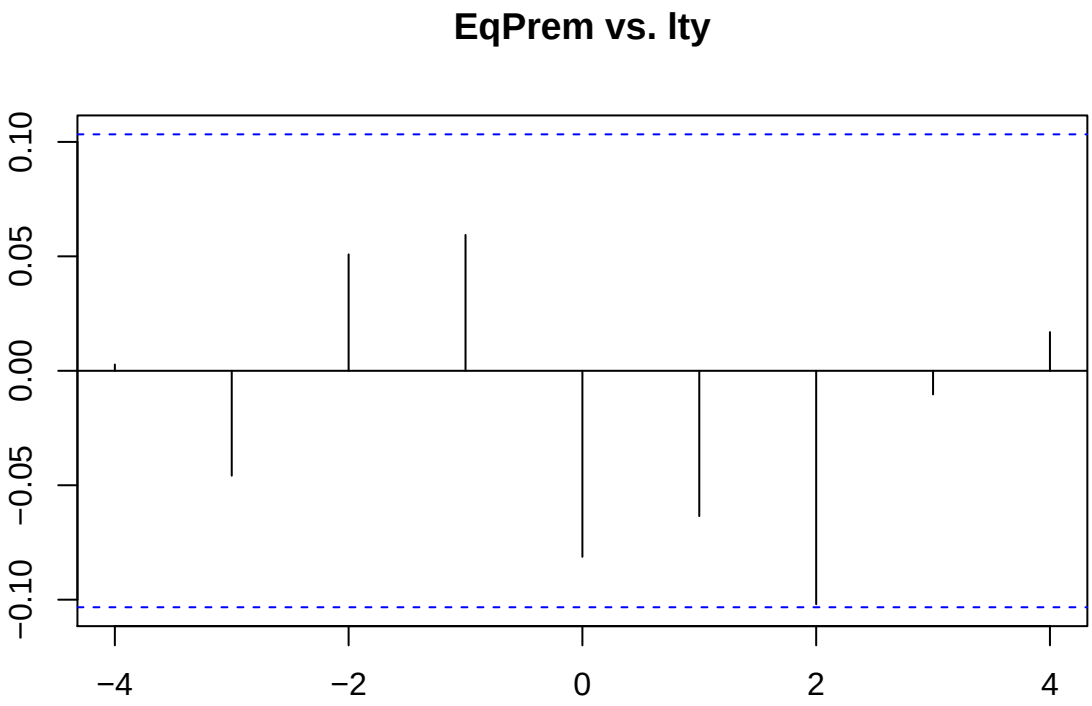
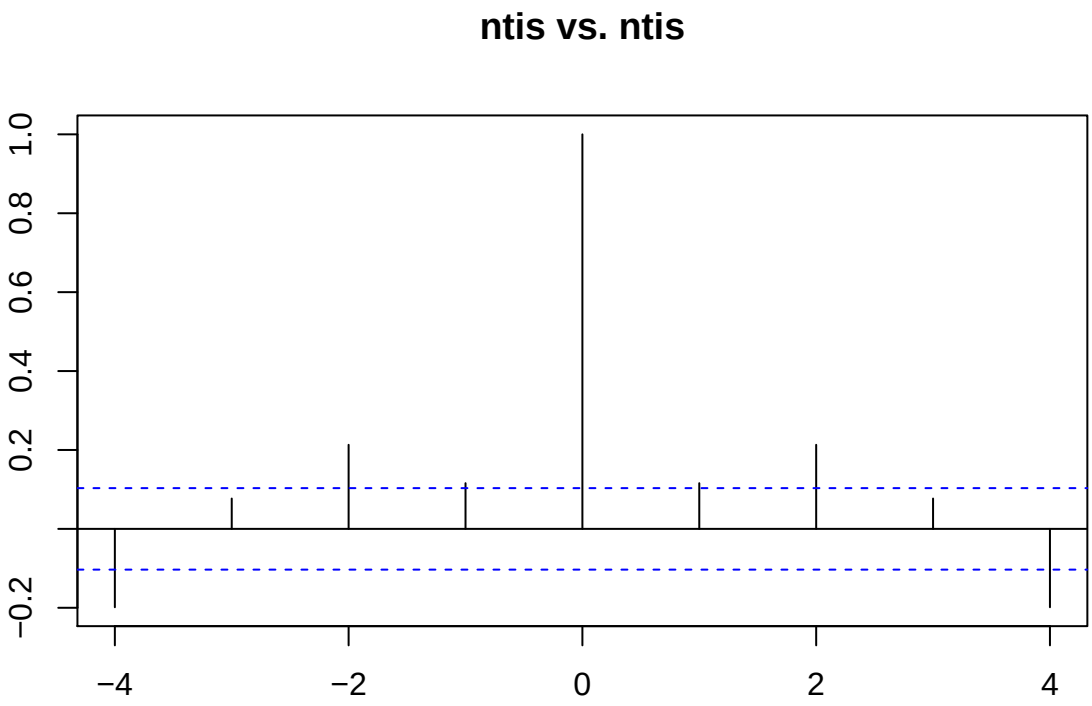
2
4

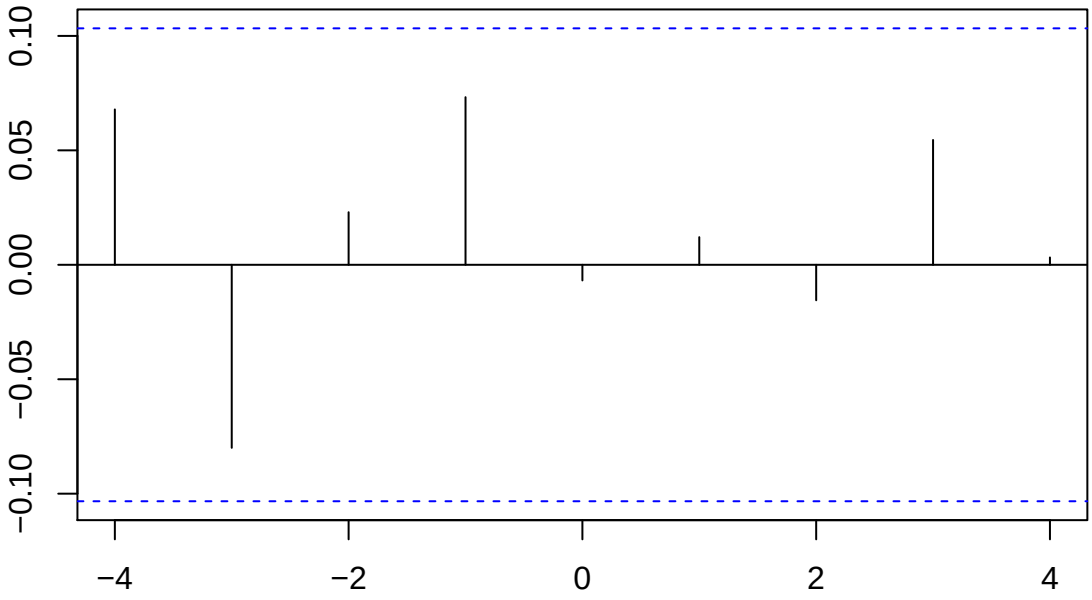

ltr vs. lty
0.6
0.2
−0.2
−0.6
−4
−2
0
2
4

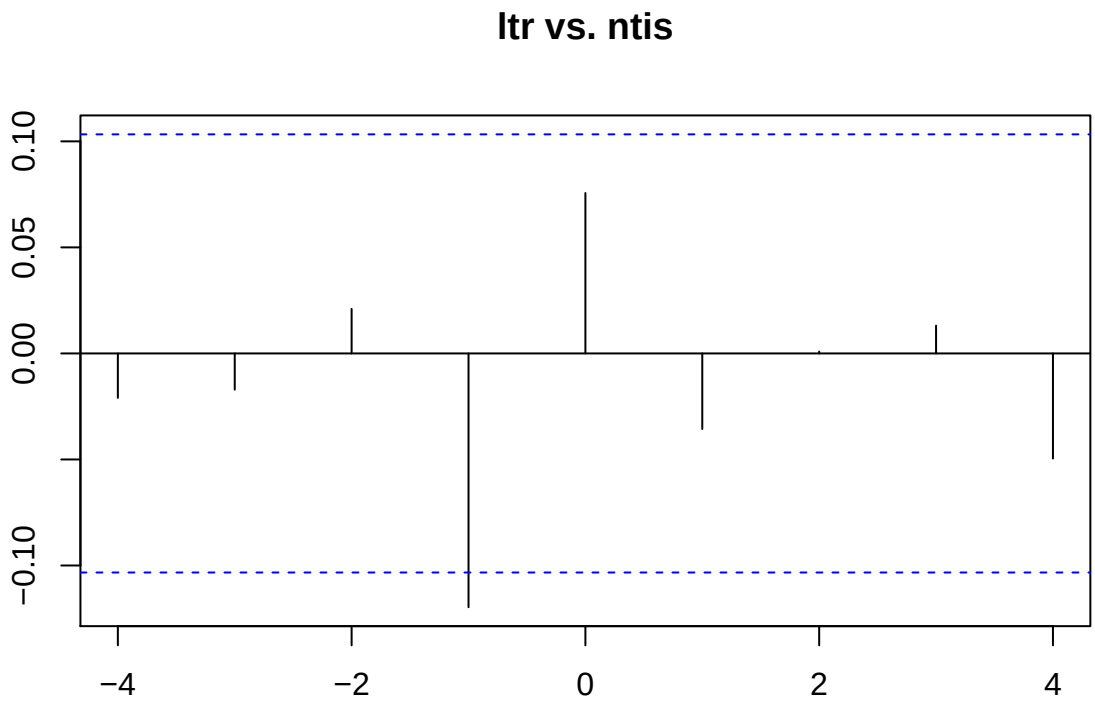

corpr vs. lty
0.6
0.4
0.2
−0.2
−0.6
−4
−2
0
2
4

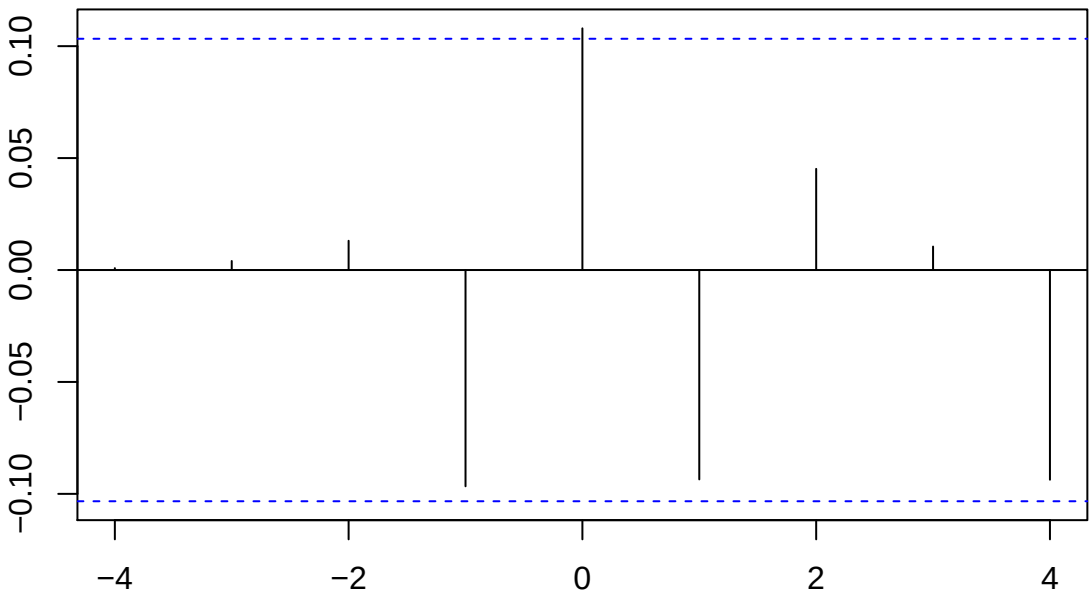

svar vs. lty
0.05
−0.05
−0.15
−4
−2
0
2
4

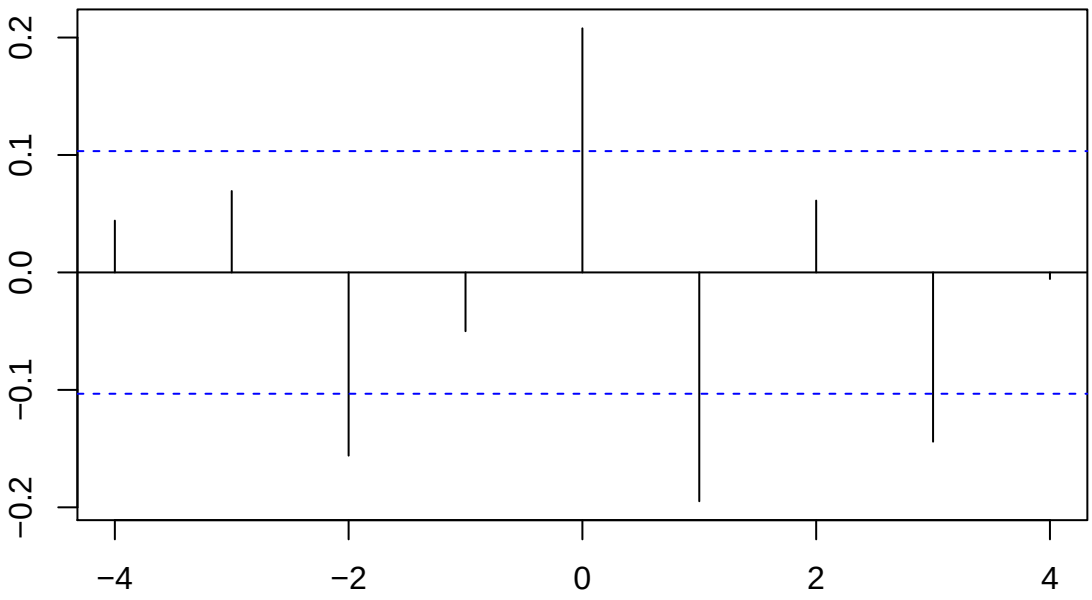

EqPrem vs. lty
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

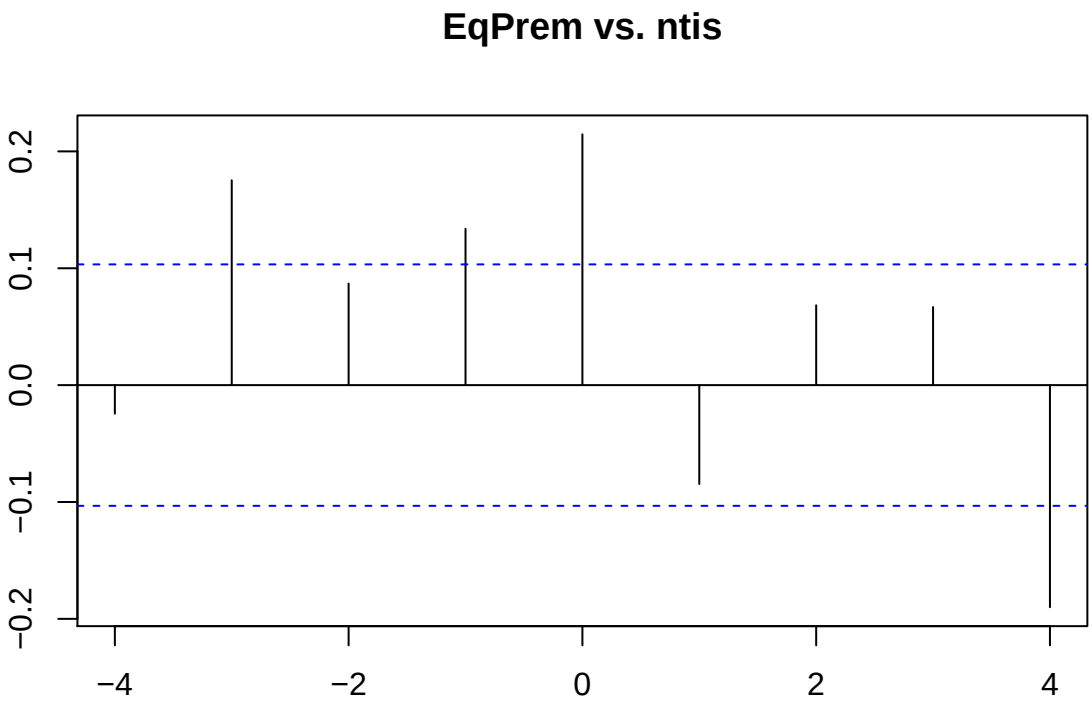

ntis vs. ntis
1.0
0.8
0.6
0.4
0.2
−0.2
−4
−2
0
2
4

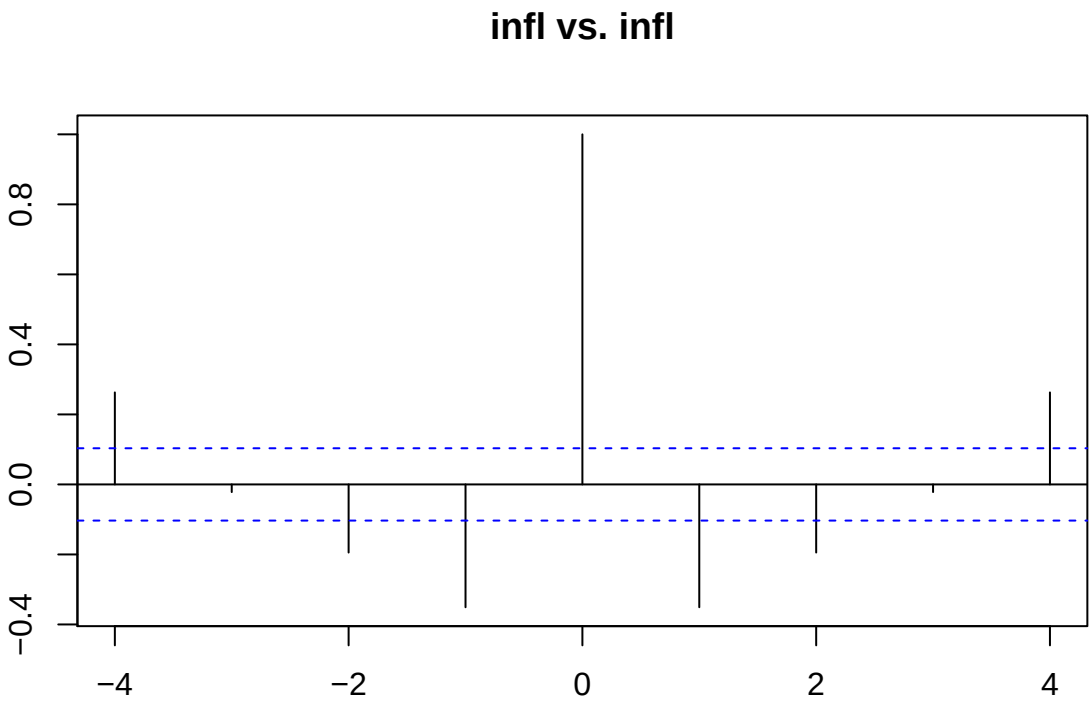

infl vs. ntis
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

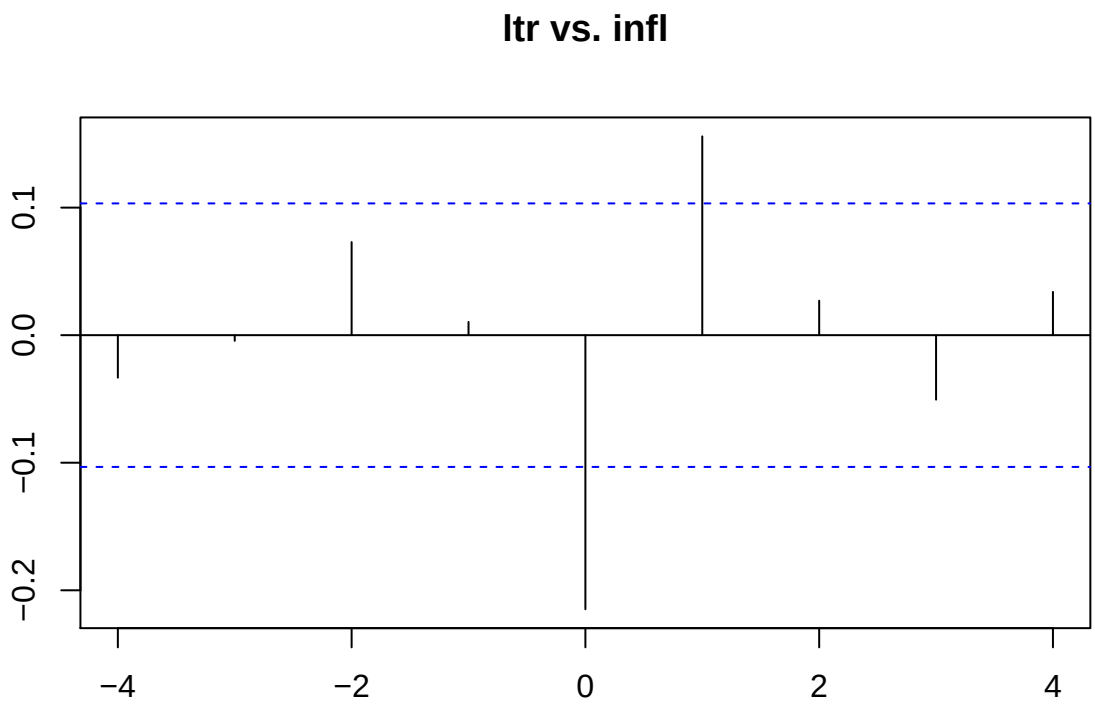

ltr vs. ntis
0.10
0.05
0.00
−0.10
−4
−2
0
2
4

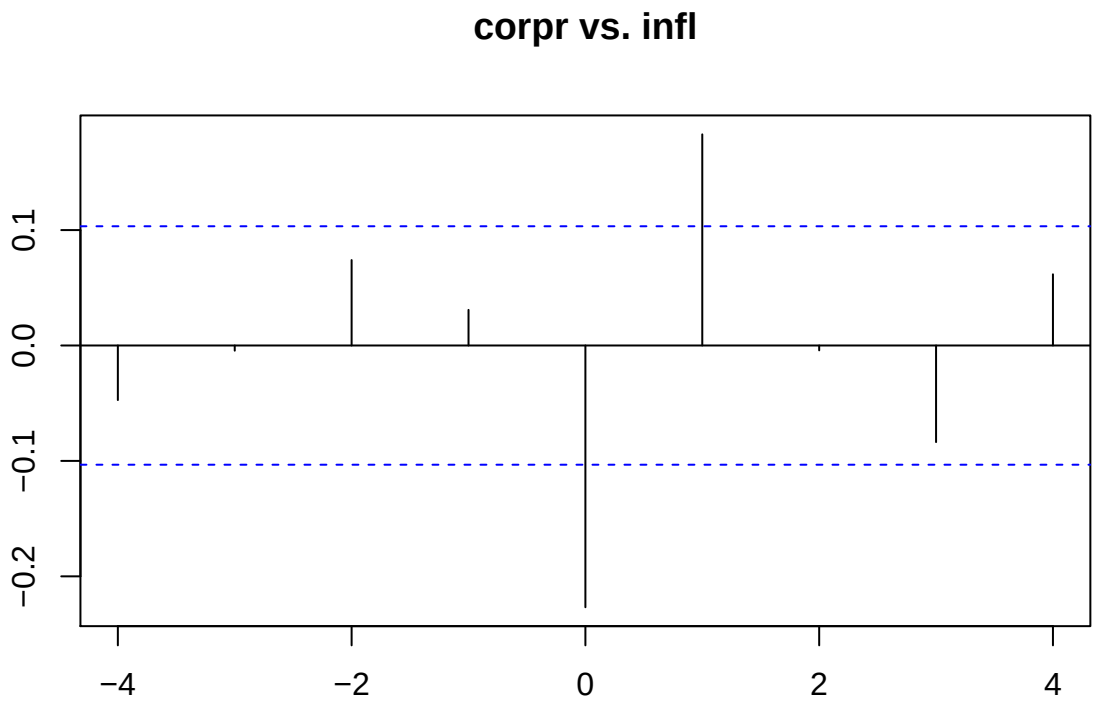

corpr vs. ntis
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

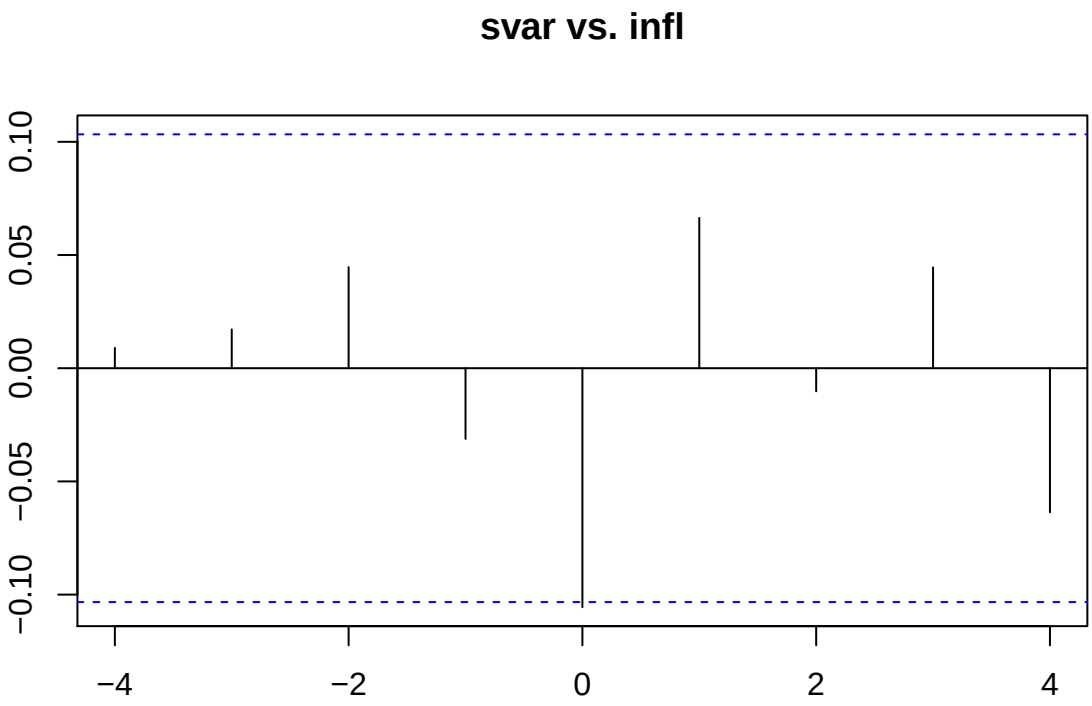

svar vs. ntis
0.2
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4

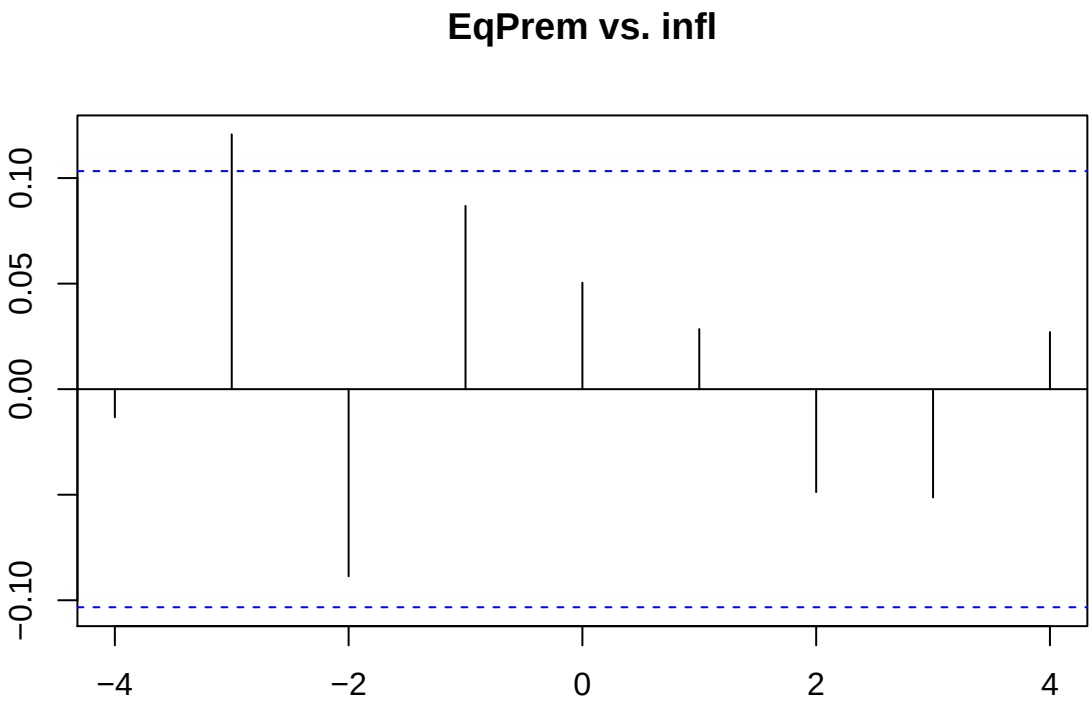

EqPrem vs. ntis
0.2
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4

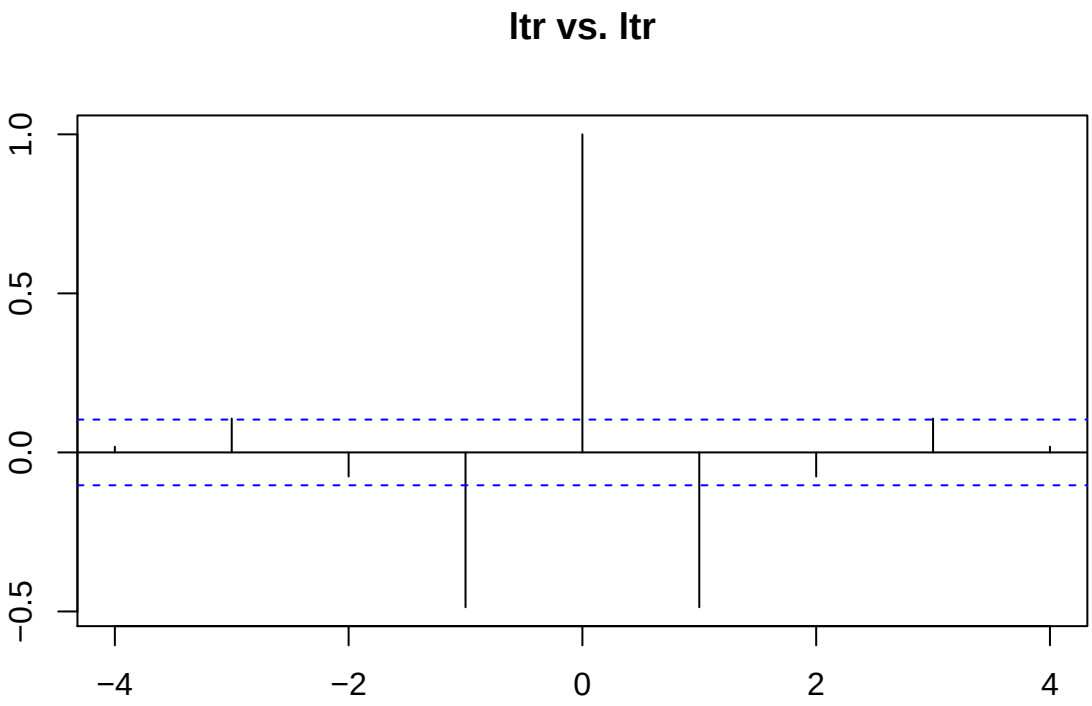

infl vs. infl
0.8
0.4
0.0
−0.4
−4
−2
0
2
4

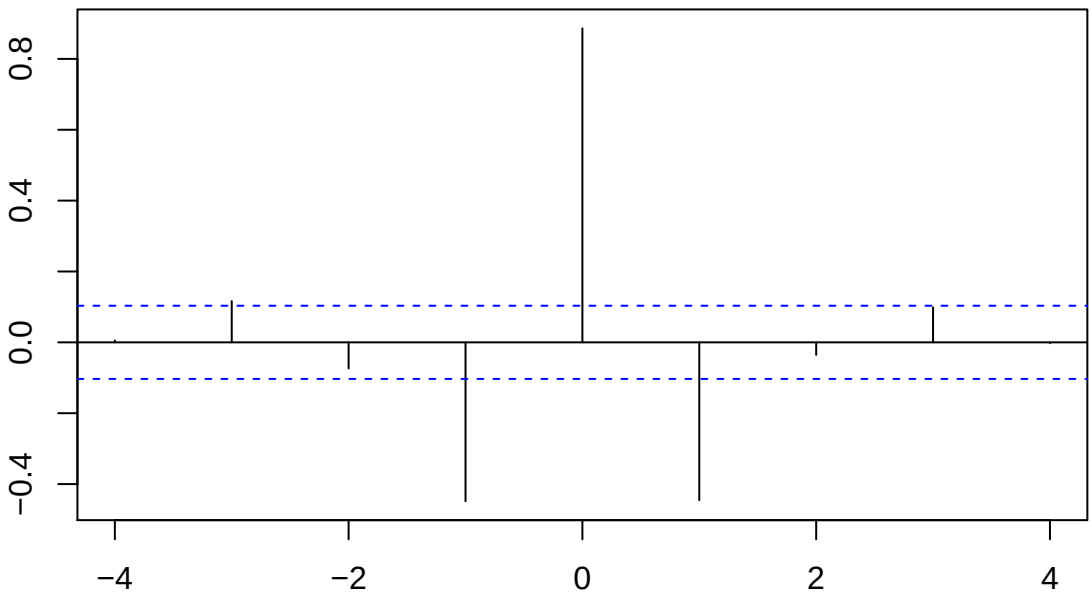

ltr vs. infl
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4

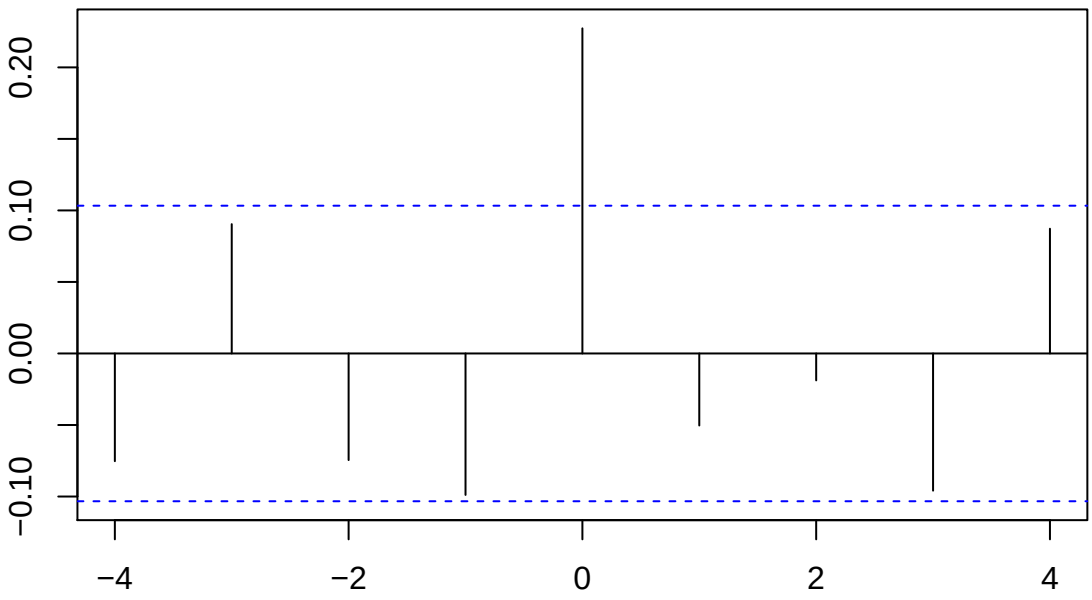

corpr vs. infl
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4

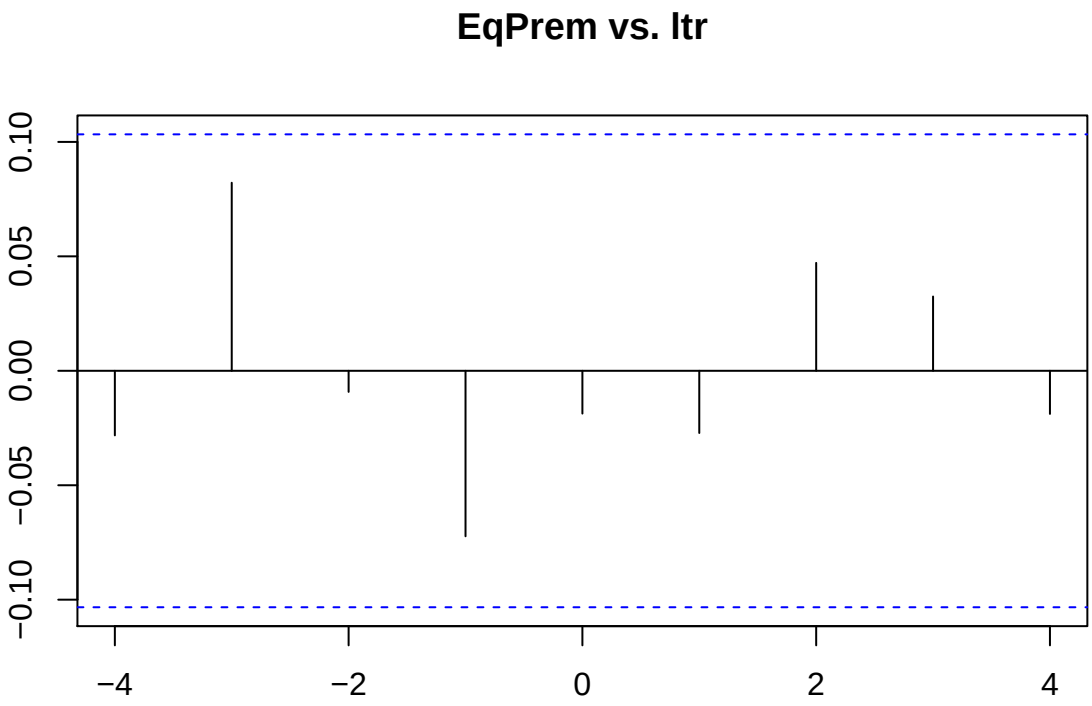

svar vs. infl
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

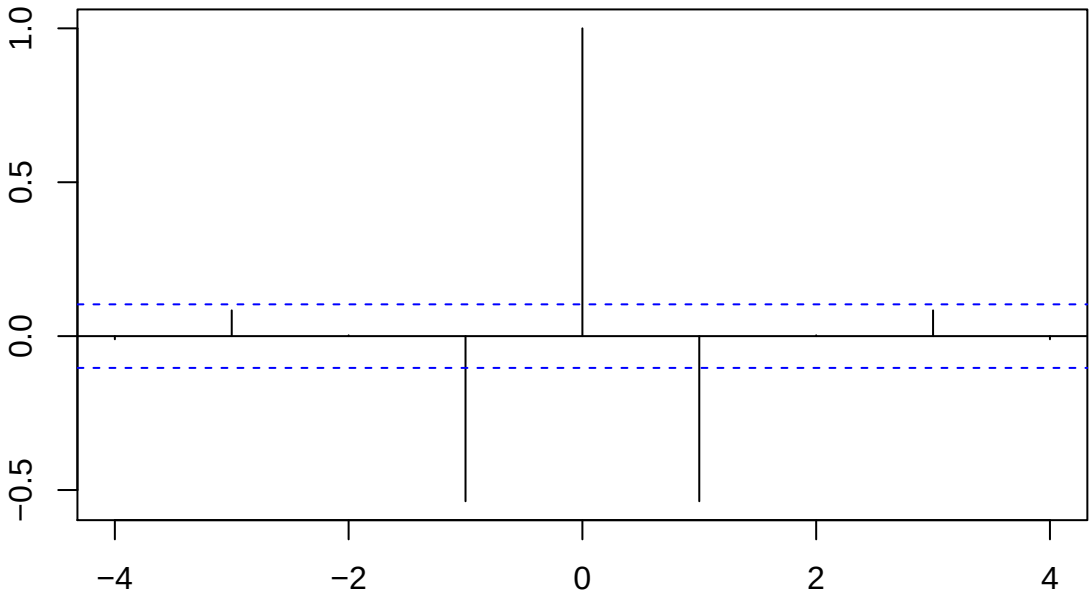

EqPrem vs. infl
0.10
0.05
0.00
−0.10
−4
−2
0
2
4

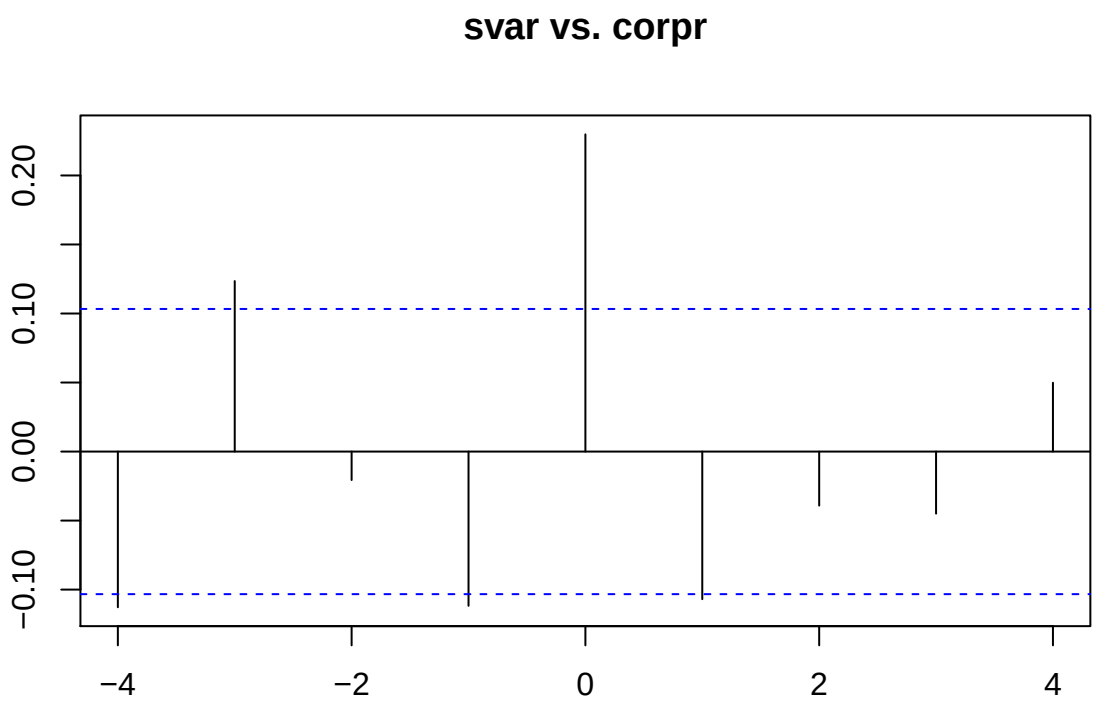

ltr vs. ltr
1.0
0.5
0.0
−0.5
−4
−2
0
2
4

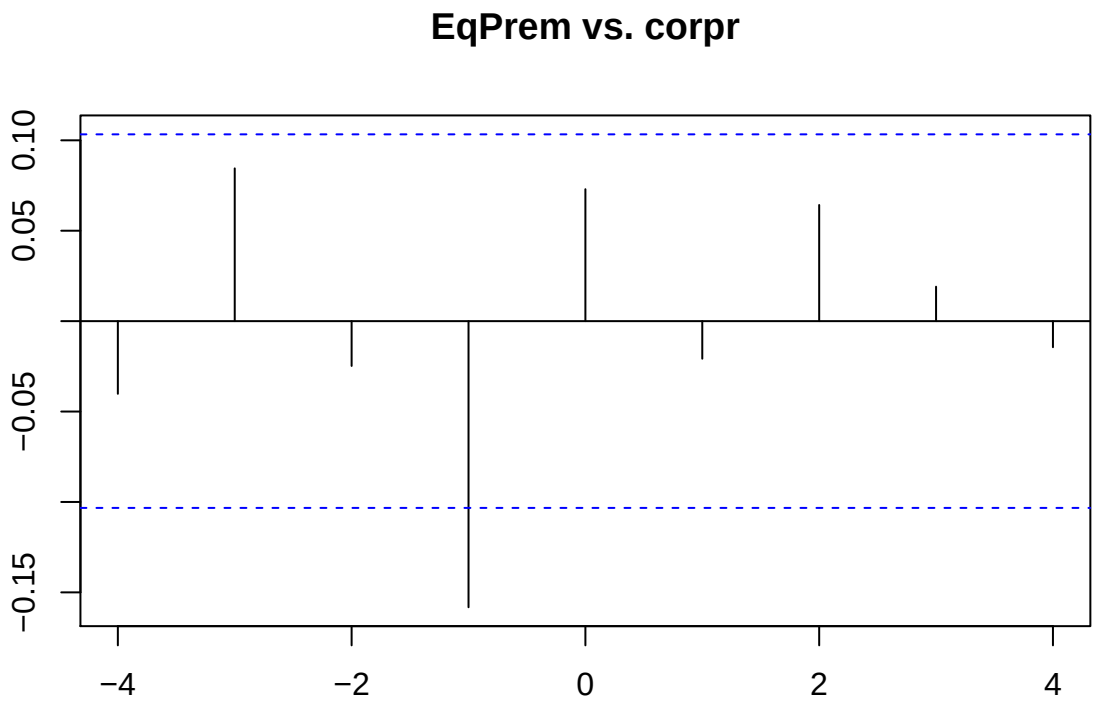

corpr vs. ltr
0.8
0.4
0.0
−0.4
−4
−2
0
2
4

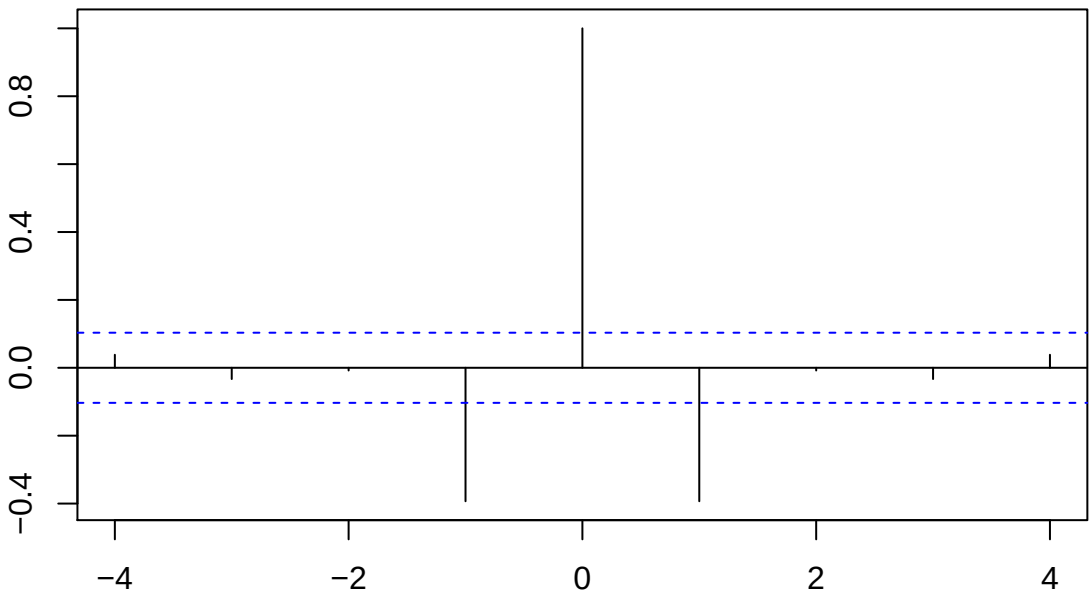

svar vs. ltr
0.20
0.10
0.00
−0.10
−4
−2
0
2
4

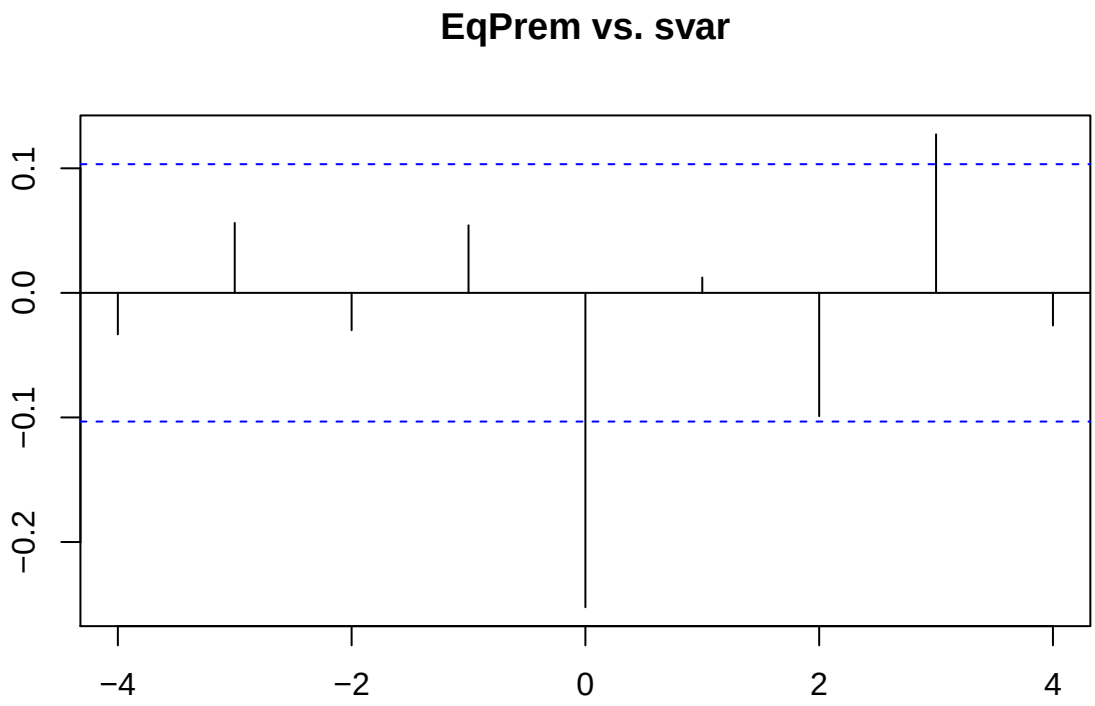

EqPrem vs. ltr
0.10
0.05
0.00
−0.05
−0.10
−4
−2
0
2
4

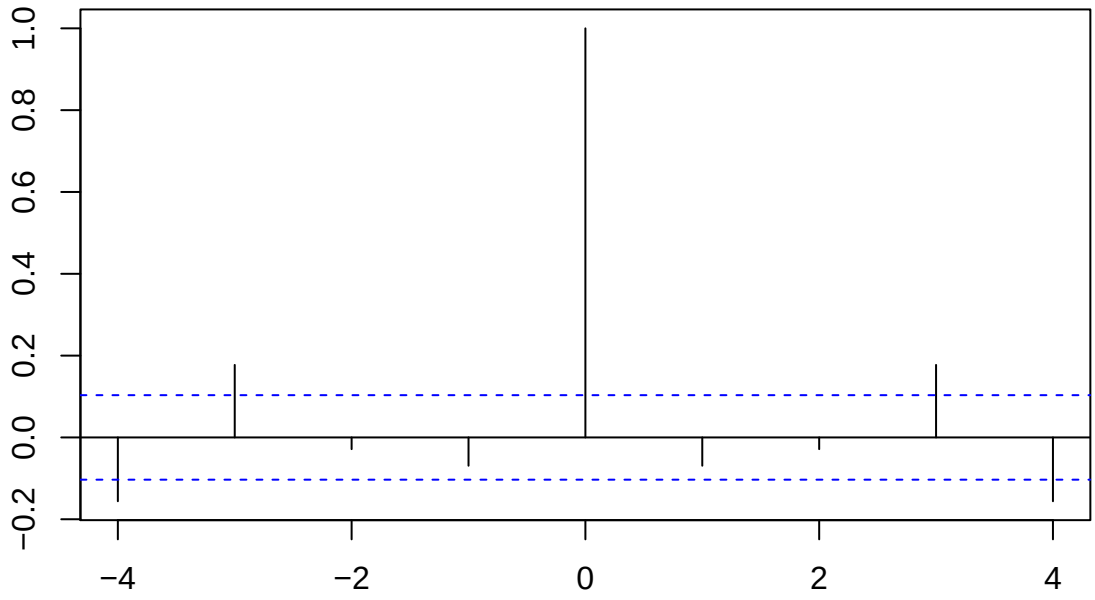

corpr vs. corpr
1.0
0.5
0.0
−0.5
−4
−2
0
2
4


svar vs. corpr
0.20
0.10
0.00
−0.10
−4
−2
0
2
4


EqPrem vs. corpr
0.10
0.05
−0.05
−0.15
−4
−2
0
2
4


svar vs. svar
0.8
0.4
0.0
−0.4
−4
−2
0
2
4


EqPrem vs. svar
0.1
0.0
−0.1
−0.2
−4
−2
0
2
4




```
##        [,1]                           [,2]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,3]                           [,4]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,5]                           [,6]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,7]                           [,8]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
```

```
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,9]                             [,10]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,11]                            [,12]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,13]                            [,14]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,15]                            [,16]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,17]                            [,18]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,19]                            [,20]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,21]                            [,22]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
## n.used 360                              360
## lag    Numeric,9                        Numeric,9
## series "X"                              "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,23]                            [,24]
## acf    Numeric,9                        Numeric,9
## type   "correlation"                    "correlation"
```

```
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,25]                           [,26]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,27]                           [,28]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,29]                           [,30]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,31]                           [,32]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,33]                           [,34]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,35]                           [,36]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,37]                           [,38]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,39]                           [,40]
```

```
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,41]                          [,42]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,43]                          [,44]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,45]                          [,46]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,47]                          [,48]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,49]                          [,50]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,51]                          [,52]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,53]                          [,54]
## acf    Numeric,9                      Numeric,9
## type   "correlation"                  "correlation"
## n.used 360                            360
## lag    Numeric,9                      Numeric,9
## series "X"                            "X"
```

```
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,55]                           [,56]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,57]                           [,58]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,59]                           [,60]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,61]                           [,62]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,63]                           [,64]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,65]                           [,66]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,67]                           [,68]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,69]                           [,70]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
```

```
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,71]                           [,72]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,73]                           [,74]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,75]                           [,76]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,77]                           [,78]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,79]                           [,80]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,81]                           [,82]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,83]                           [,84]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,85]                           [,86]
## acf    Numeric,9                       Numeric,9
```

```
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,87]                           [,88]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,89]                           [,90]
## acf    Numeric,9                       Numeric,9
## type   "correlation"                   "correlation"
## n.used 360                             360
## lag    Numeric,9                       Numeric,9
## series "X"                             "X"
## snames "corrdata[, i] & corrdata[, j]" "corrdata[, i] & corrdata[, j]"
##        [,91]
## acf    Numeric,9
## type   "correlation"
## n.used 360
## lag    Numeric,9
## series "X"
## snames "corrdata[, i] & corrdata[, j]"
```