Data - Visualization

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Data Visualization

We visualize the data (stocks and sentix). For consistency, we first specify general parameters on how to display each index and the time periods.

overall parameters

Lines with data

```
geomLineDataDAX <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = DAX, colour = \"DAX\"))"))
}
geomLineDataTEC <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = TEC, colour = \"TEC\"))"))
}
geomLineDataESX50 <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = ESX50, colour = \"ESX50\"))"))
}
geomLineDataSP5 <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = SP5, colour = \"SP5\"))"))
}
geomLineDataNASDAQ <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = NASDAQ, colour = \"NASDAQ\"))"))
}
geomLineDataNIKKEI <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = NIKKEI, colour = \"NIKKEI\"))"))
}
geomLineDataBUND <- function(x){
    parse(text = paste0("geom_line(data = ", x, ", aes(x = Datum, y = BUND, colour = \"BUND\"))"))
}
```

probierer, funktioniert nicht (wollte alle linien auf einmal plotten)

```
# geomLineData <- function(x){
#     parse(text = paste0("eval(geomLineDataDAX(\"", x , "\")) + eval(geomLineDataTEC(\"", x , "\"))"))
# }
#
# ggplot() +
#     eval(geomLineData("retPlot")) +
#     eval(geomRectDateLast) +
#     labs(x = "Time", y = "Value")
```

Rectangle for Date periods

store as function to keep structure similar to above (and store at same Place in environment)

```
geomRectDateLast <- function(){
    parse(text = "geom_rect(aes(xmin = min(datesEvalLast), xmax = max(datesEvalLast), ymin = -Inf, ymax

geomRectDateBear <- function(){
    parse(text = "geom_rect(aes(xmin = min(datesEvalBear), xmax = max(datesEvalBear), ymin = -Inf, ymax

geomRectDateBull <- function(){
    parse(text = "geom_rect(aes(xmin = min(datesEvalBull), xmax = max(datesEvalBull), ymin = -Inf, ymax
```

Function for plotting

```
plotData <- function(x, title = "Indices"){
    ggplot() +
        eval(geomLineDataDAX(x)) +
        eval(geomLineDataTEC(x)) +
        eval(geomLineDataESX50(x)) +
        eval(geomLineDataNASDAQ(x)) +
        eval(geomLineDataNIKKEI(x)) +
        eval(geomLineDataBUND(x)) +
        eval(geomRectDateLast()) +
        eval(geomRectDateBear()) +
        eval(geomRectDateBull()) +
        labs(x = "Time", y = "Value") +
        labs(title = title) +
        theme(plot.title = element_text(hjust = 0.5)) # align title in center
}

## if a special name is given, take it, otherwise take x (plot sentix by using same dataframe (adopted)
plotDataPDF <- function(x, xName = x){
    pdf(file.path(getwd(), "Plot Data", paste0(xName, ".pdf")), width = 10, height = 4)
    plot(plotData(x))
    dev.off()
}
```

Stocks

Start of with a value of 100 for each stock and then plot the evolvment of this stock.

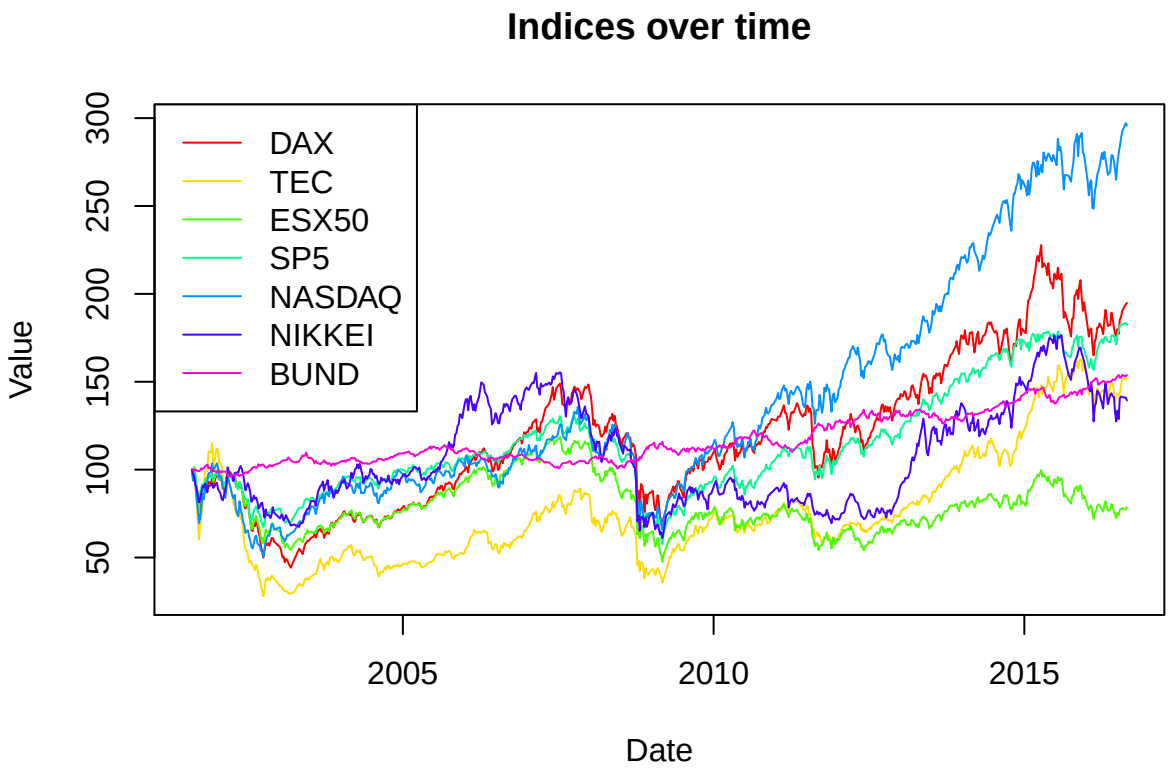
plot()

```
retPlot <- matrix(100, nrow = nrow(stocks), ncol = ncol(stocks)-1)
retPlot[2:nrow(stocks), ] <- 1+ret # to multiply lateron, we have to add 1
retPlot <- apply(retPlot, 2, cumprod)
rownames(retPlot) <- stocks[,1]

xNames <- rownames(retPlot)
class(xNames) <- "Date"   # convert to date

cols <- rainbow(ncol(retPlot))
ylim <- c(min(retPlot), max(retPlot))
```

```
plot(xNames, retPlot[,1], type = "l", xlab = "Date", ylab = "Value", main = "Indices over time",
     col = cols[1], ylim = ylim)
for(i in 2:ncol(retPlot)){
    par(new=T)
    plot(xNames, retPlot[,i], type = "l", col = cols[i], axes = F, xlab="", ylab="", ylim = ylim)
}
legend("topleft", legend = colnames(stocks)[2:ncol(stocks)], col = cols, lty = 1)
```




```
rm(retPlot, xNames, ylim, i)
```

ggplot()

```
library(ggplot2)
```

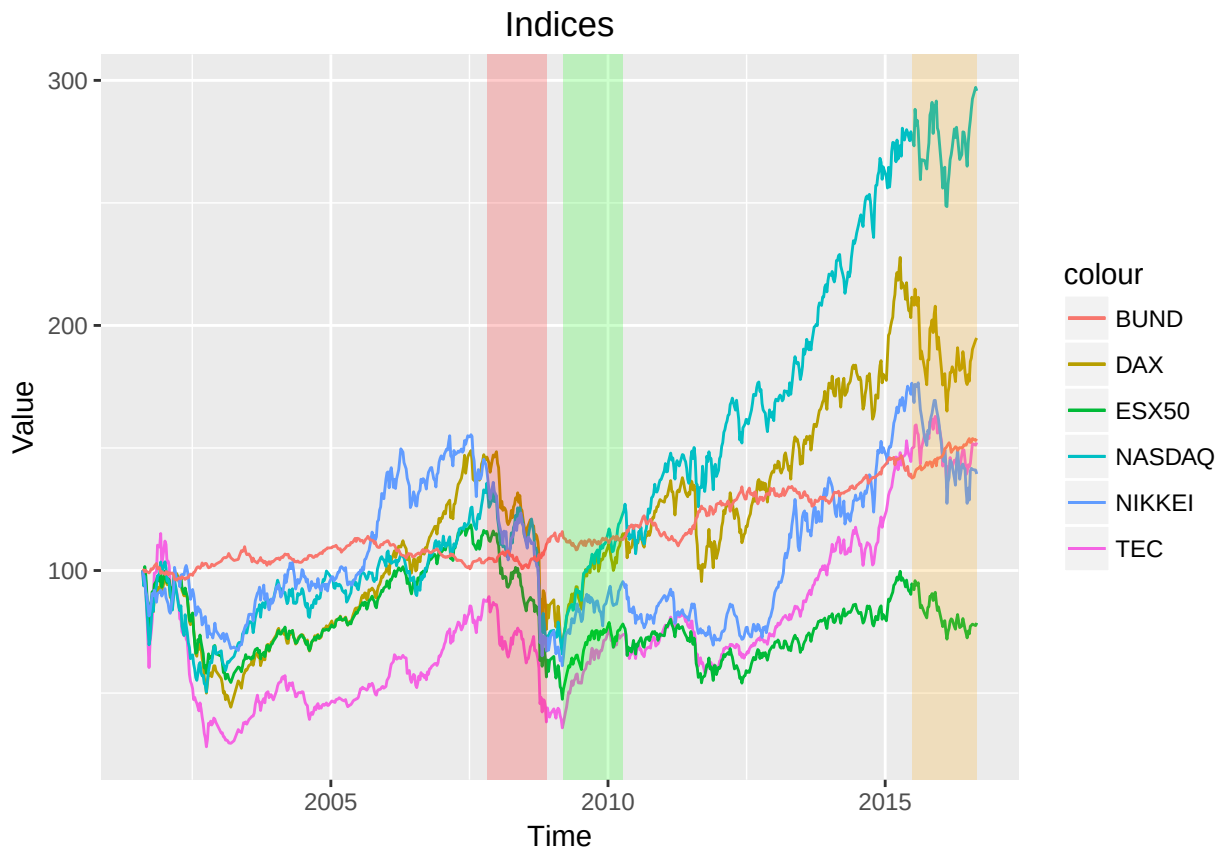
need data frame as input for ggplot

```
retPlot <- matrix(100, nrow = nrow(stocks), ncol = ncol(stocks)-1)
retPlot[2:nrow(stocks), ] <- 1+ret # to multiply lateron, we have to add 1
retPlot <- apply(retPlot, 2, cumprod)

retPlot <- as.data.frame(retPlot)
colnames(retPlot) <- colnames(stocks)[2:ncol(stocks)]
retPlot$Datum <- stocks[,1]
class(retPlot$Datum) <- "Date"    # convert to date
```

```
cols <- rainbow(ncol(retPlot))
ylim <- c(min(retPlot[,1:(ncol(retPlot)-1)]), max(retPlot[,1:(ncol(retPlot)-1)]))


plotData("retPlot")
```




```
plotDataPDF("retPlot")
```

```
## pdf
##   2
```

Dispersion

Graphs can be found in "\R-Research Project Statistics\Plot Data".

```
for(i in names(sDisp)){
    sPlot <- sDisp[[i]]
    plotDataPDF("sPlot", paste("sDisp", i))
}
```

And we provide summary statistics.

```
lapply(sDisp, function(x) {summary(x[,-1], digits = 2)})
```

```
## $P1
##       DAX             TEC             ESX50           SP5
##  Min.   :0.39   Min.   :0.39   Min.   :0.39   Min.   :0.39
```

```
##  1st Qu.:0.55   1st Qu.:0.54   1st Qu.:0.53   1st Qu.:0.51
##  Median :0.58   Median :0.57   Median :0.56   Median :0.55
##  Mean   :0.58   Mean   :0.57   Mean   :0.56   Mean   :0.55
##  3rd Qu.:0.62   3rd Qu.:0.60   3rd Qu.:0.59   3rd Qu.:0.58
##  Max.   :0.76   Max.   :0.74   Max.   :0.75   Max.   :0.73
##      NASDAQ         NIKKEI          BUND
##  Min.   :0.42   Min.   :0.31   Min.   :0.15
##  1st Qu.:0.53   1st Qu.:0.48   1st Qu.:0.37
##  Median :0.56   Median :0.51   Median :0.41
##  Mean   :0.56   Mean   :0.51   Mean   :0.40
##  3rd Qu.:0.59   3rd Qu.:0.54   3rd Qu.:0.45
##  Max.   :0.74   Max.   :0.71   Max.   :0.57
##
## $P6
##       DAX            TEC           ESX50           SP5
##  Min.   :0.49   Min.   :0.46   Min.   :0.49   Min.   :0.47
##  1st Qu.:0.63   1st Qu.:0.62   1st Qu.:0.62   1st Qu.:0.61
##  Median :0.66   Median :0.65   Median :0.65   Median :0.64
##  Mean   :0.66   Mean   :0.65   Mean   :0.64   Mean   :0.64
##  3rd Qu.:0.69   3rd Qu.:0.68   3rd Qu.:0.68   3rd Qu.:0.67
##  Max.   :0.76   Max.   :0.75   Max.   :0.75   Max.   :0.75
##      NASDAQ         NIKKEI          BUND
##  Min.   :0.49   Min.   :0.37   Min.   :0.38
##  1st Qu.:0.62   1st Qu.:0.56   1st Qu.:0.49
##  Median :0.65   Median :0.60   Median :0.52
##  Mean   :0.65   Mean   :0.59   Mean   :0.52
##  3rd Qu.:0.68   3rd Qu.:0.62   3rd Qu.:0.55
##  Max.   :0.75   Max.   :0.71   Max.   :0.66
##
## $I1
##       DAX            TEC           ESX50           SP5
##  Min.   :0.30   Min.   :0.34   Min.   :0.30   Min.   :0.33
##  1st Qu.:0.55   1st Qu.:0.53   1st Qu.:0.53   1st Qu.:0.51
##  Median :0.59   Median :0.58   Median :0.58   Median :0.55
##  Mean   :0.59   Mean   :0.58   Mean   :0.58   Mean   :0.56
##  3rd Qu.:0.63   3rd Qu.:0.62   3rd Qu.:0.62   3rd Qu.:0.60
##  Max.   :0.85   Max.   :0.80   Max.   :0.83   Max.   :0.81
##      NASDAQ         NIKKEI          BUND
##  Min.   :0.31   Min.   :0.27   Min.   :0.29
##  1st Qu.:0.51   1st Qu.:0.46   1st Qu.:0.44
##  Median :0.56   Median :0.50   Median :0.49
##  Mean   :0.56   Mean   :0.51   Mean   :0.49
##  3rd Qu.:0.61   3rd Qu.:0.55   3rd Qu.:0.54
##  Max.   :0.79   Max.   :0.78   Max.   :0.78
##
## $I6
##       DAX            TEC           ESX50           SP5
##  Min.   :0.41   Min.   :0.40   Min.   :0.39   Min.   :0.44
##  1st Qu.:0.61   1st Qu.:0.61   1st Qu.:0.60   1st Qu.:0.59
##  Median :0.66   Median :0.65   Median :0.65   Median :0.63
##  Mean   :0.65   Mean   :0.65   Mean   :0.64   Mean   :0.63
##  3rd Qu.:0.70   3rd Qu.:0.69   3rd Qu.:0.69   3rd Qu.:0.68
##  Max.   :0.82   Max.   :0.80   Max.   :0.81   Max.   :0.77
##      NASDAQ         NIKKEI          BUND
```

```
##  Min.   :0.43   Min.   :0.36   Min.   :0.28
##  1st Qu.:0.60   1st Qu.:0.53   1st Qu.:0.49
##  Median :0.63   Median :0.58   Median :0.56
##  Mean   :0.63   Mean   :0.57   Mean   :0.55
##  3rd Qu.:0.67   3rd Qu.:0.62   3rd Qu.:0.61
##  Max.   :0.81   Max.   :0.73   Max.   :0.75
##
## $G1
##       DAX             TEC            ESX50           SP5
##  Min.   :0.39   Min.   :0.40   Min.   :0.39   Min.   :0.38
##  1st Qu.:0.55   1st Qu.:0.54   1st Qu.:0.54   1st Qu.:0.52
##  Median :0.59   Median :0.57   Median :0.57   Median :0.55
##  Mean   :0.59   Mean   :0.57   Mean   :0.57   Mean   :0.55
##  3rd Qu.:0.62   3rd Qu.:0.61   3rd Qu.:0.60   3rd Qu.:0.58
##  Max.   :0.78   Max.   :0.75   Max.   :0.76   Max.   :0.75
##      NASDAQ          NIKKEI          BUND
##  Min.   :0.42   Min.   :0.32   Min.   :0.21
##  1st Qu.:0.53   1st Qu.:0.48   1st Qu.:0.39
##  Median :0.56   Median :0.51   Median :0.43
##  Mean   :0.56   Mean   :0.51   Mean   :0.43
##  3rd Qu.:0.59   3rd Qu.:0.54   3rd Qu.:0.47
##  Max.   :0.75   Max.   :0.73   Max.   :0.59
##
## $G6
##       DAX             TEC            ESX50           SP5
##  Min.   :0.52   Min.   :0.48   Min.   :0.49   Min.   :0.49
##  1st Qu.:0.63   1st Qu.:0.62   1st Qu.:0.62   1st Qu.:0.61
##  Median :0.66   Median :0.66   Median :0.65   Median :0.64
##  Mean   :0.66   Mean   :0.65   Mean   :0.65   Mean   :0.64
##  3rd Qu.:0.69   3rd Qu.:0.68   3rd Qu.:0.68   3rd Qu.:0.67
##  Max.   :0.76   Max.   :0.75   Max.   :0.75   Max.   :0.75
##      NASDAQ          NIKKEI          BUND
##  Min.   :0.50   Min.   :0.39   Min.   :0.38
##  1st Qu.:0.62   1st Qu.:0.56   1st Qu.:0.49
##  Median :0.65   Median :0.59   Median :0.53
##  Mean   :0.65   Mean   :0.59   Mean   :0.53
##  3rd Qu.:0.67   3rd Qu.:0.62   3rd Qu.:0.56
##  Max.   :0.74   Max.   :0.71   Max.   :0.67
```

Herfindahl

Graphs can be found in "\R-Research Project Statistics\Plot Data".

```
for(i in names(sHerf)){
    sPlot <- sHerf[[i]]
    plotDataPDF("sPlot", paste("sHerf", i))
}
```

And we provide summary statistics.

```
lapply(sHerf, function(x) {summary(x[,-1], digits = 2)})
```

```
## $P1
##       DAX              TEC             ESX50             SP5
##  Min.   :-0.67   Min.   :-0.67   Min.   :-0.76   Min.   :-0.82
```

```
##  1st Qu.:-0.53   1st Qu.:-0.54   1st Qu.:-0.55   1st Qu.:-0.57
##  Median :-0.50   Median :-0.51   Median :-0.52   Median :-0.54
##  Mean   :-0.51   Mean   :-0.51   Mean   :-0.52   Mean   :-0.54
##  3rd Qu.:-0.48   3rd Qu.:-0.49   3rd Qu.:-0.49   3rd Qu.:-0.50
##  Max.   :-0.41   Max.   :-0.41   Max.   :-0.41   Max.   :-0.42
##      NASDAQ          NIKKEI          BUND
##  Min.   :-0.71   Min.   :-0.90   Min.   :-1.45
##  1st Qu.:-0.56   1st Qu.:-0.63   1st Qu.:-0.86
##  Median :-0.52   Median :-0.58   Median :-0.77
##  Mean   :-0.53   Mean   :-0.59   Mean   :-0.78
##  3rd Qu.:-0.49   3rd Qu.:-0.54   3rd Qu.:-0.67
##  Max.   :-0.41   Max.   :-0.42   Max.   :-0.51
##
## $P6
##       DAX             TEC             ESX50           SP5
##  Min.   :-0.61   Min.   :-0.66   Min.   :-0.63   Min.   :-0.65
##  1st Qu.:-0.47   1st Qu.:-0.47   1st Qu.:-0.47   1st Qu.:-0.48
##  Median :-0.45   Median :-0.45   Median :-0.46   Median :-0.46
##  Mean   :-0.45   Mean   :-0.46   Mean   :-0.46   Mean   :-0.47
##  3rd Qu.:-0.43   3rd Qu.:-0.44   3rd Qu.:-0.44   3rd Qu.:-0.45
##  Max.   :-0.40   Max.   :-0.41   Max.   :-0.41   Max.   :-0.41
##      NASDAQ          NIKKEI          BUND
##  Min.   :-0.61   Min.   :-0.87   Min.   :-0.71
##  1st Qu.:-0.47   1st Qu.:-0.51   1st Qu.:-0.58
##  Median :-0.45   Median :-0.49   Median :-0.54
##  Mean   :-0.46   Mean   :-0.50   Mean   :-0.55
##  3rd Qu.:-0.44   3rd Qu.:-0.47   3rd Qu.:-0.52
##  Max.   :-0.41   Max.   :-0.42   Max.   :-0.45
##
## $I1
##       DAX             TEC             ESX50           SP5
##  Min.   :-0.76   Min.   :-0.74   Min.   :-0.73   Min.   :-0.81
##  1st Qu.:-0.53   1st Qu.:-0.56   1st Qu.:-0.54   1st Qu.:-0.58
##  Median :-0.50   Median :-0.51   Median :-0.51   Median :-0.53
##  Mean   :-0.50   Mean   :-0.52   Mean   :-0.51   Mean   :-0.54
##  3rd Qu.:-0.47   3rd Qu.:-0.48   3rd Qu.:-0.47   3rd Qu.:-0.49
##  Max.   :-0.40   Max.   :-0.40   Max.   :-0.40   Max.   :-0.40
##      NASDAQ          NIKKEI          BUND
##  Min.   :-0.76   Min.   :-1.10   Min.   :-1.03
##  1st Qu.:-0.58   1st Qu.:-0.64   1st Qu.:-0.69
##  Median :-0.53   Median :-0.58   Median :-0.61
##  Mean   :-0.54   Mean   :-0.59   Mean   :-0.63
##  3rd Qu.:-0.49   3rd Qu.:-0.53   3rd Qu.:-0.54
##  Max.   :-0.40   Max.   :-0.40   Max.   :-0.42
##
## $I6
##       DAX             TEC             ESX50           SP5
##  Min.   :-0.61   Min.   :-0.68   Min.   :-0.60   Min.   :-0.71
##  1st Qu.:-0.48   1st Qu.:-0.48   1st Qu.:-0.49   1st Qu.:-0.50
##  Median :-0.45   Median :-0.45   Median :-0.45   Median :-0.47
##  Mean   :-0.46   Mean   :-0.46   Mean   :-0.46   Mean   :-0.47
##  3rd Qu.:-0.43   3rd Qu.:-0.43   3rd Qu.:-0.43   3rd Qu.:-0.44
##  Max.   :-0.40   Max.   :-0.40   Max.   :-0.40   Max.   :-0.41
##      NASDAQ          NIKKEI          BUND
```

```
##  Min.   :-0.65   Min.   :-0.83   Min.   :-0.97
##  1st Qu.:-0.49   1st Qu.:-0.53   1st Qu.:-0.56
##  Median :-0.47   Median :-0.50   Median :-0.51
##  Mean   :-0.47   Mean   :-0.51   Mean   :-0.52
##  3rd Qu.:-0.44   3rd Qu.:-0.48   3rd Qu.:-0.48
##  Max.   :-0.41   Max.   :-0.41   Max.   :-0.42
##
## $G1
##       DAX             TEC             ESX50            SP5
##  Min.   :-0.65   Min.   :-0.67   Min.   :-0.67   Min.   :-0.77
##  1st Qu.:-0.53   1st Qu.:-0.54   1st Qu.:-0.54   1st Qu.:-0.57
##  Median :-0.50   Median :-0.51   Median :-0.52   Median :-0.53
##  Mean   :-0.50   Mean   :-0.51   Mean   :-0.52   Mean   :-0.54
##  3rd Qu.:-0.48   3rd Qu.:-0.48   3rd Qu.:-0.49   3rd Qu.:-0.50
##  Max.   :-0.40   Max.   :-0.41   Max.   :-0.41   Max.   :-0.41
##      NASDAQ          NIKKEI           BUND
##  Min.   :-0.71   Min.   :-0.94   Min.   :-1.27
##  1st Qu.:-0.56   1st Qu.:-0.62   1st Qu.:-0.80
##  Median :-0.52   Median :-0.58   Median :-0.72
##  Mean   :-0.53   Mean   :-0.59   Mean   :-0.73
##  3rd Qu.:-0.49   3rd Qu.:-0.54   3rd Qu.:-0.64
##  Max.   :-0.41   Max.   :-0.41   Max.   :-0.49
##
## $G6
##       DAX             TEC             ESX50            SP5
##  Min.   :-0.56   Min.   :-0.63   Min.   :-0.58   Min.   :-0.60
##  1st Qu.:-0.46   1st Qu.:-0.47   1st Qu.:-0.47   1st Qu.:-0.48
##  Median :-0.45   Median :-0.45   Median :-0.45   Median :-0.46
##  Mean   :-0.45   Mean   :-0.46   Mean   :-0.46   Mean   :-0.47
##  3rd Qu.:-0.43   3rd Qu.:-0.44   3rd Qu.:-0.44   3rd Qu.:-0.44
##  Max.   :-0.40   Max.   :-0.41   Max.   :-0.41   Max.   :-0.41
##      NASDAQ          NIKKEI           BUND
##  Min.   :-0.60   Min.   :-0.82   Min.   :-0.68
##  1st Qu.:-0.47   1st Qu.:-0.51   1st Qu.:-0.57
##  Median :-0.46   Median :-0.49   Median :-0.53
##  Mean   :-0.46   Mean   :-0.50   Mean   :-0.54
##  3rd Qu.:-0.44   3rd Qu.:-0.48   3rd Qu.:-0.51
##  Max.   :-0.41   Max.   :-0.42   Max.   :-0.44
```