

Data - Import and Preparation

Stefan Glogger

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Data Import

We import the sentiment data. We also import the prices of each index over the relevant time frame.

Sentix

Read the raw sentiment data and save it in the list *sentixRaw* with each list element containing the results of the survey for the different indices. As the number of rows (dates of observation) in data differ, we extract the unique dates (*datesSentix*) and reduce the data to it. We also determine *dateMin* and *dateMax*, which we use later on to get the stock data.

```
library(openxlsx)
```

```
folderSentix <- (file.path(getwd(), "Data", "Sentix"))
```

```
sheets <- c("DAX", "DAXm", "TEC", "TECm", "ESX50", "ESX50m", "SP5", "SP5m", "NASDAQ", "NASDAQm", "NIKKEI", "NIKKEIm", "BUND", "BUNDm", "TBOND", "TBONDm")
relevant_rows <- c("Datum", "P+", "Pn", "P-", "I+", "In", "I-", "G+", "Gn", "G-")
```

```
sentixRaw <- list()
```

```
for(i in sheets){
  sentixRaw[[i]] <- read.xlsx(file.path(folderSentix, "sentix_anzahlen_bis_02092016xlsx.xlsx"), sheet=i, startRow=1, endRow=10000, colNames=TRUE, dataOnly=FALSE)
  sentixRaw[[i]] <- sentixRaw[[i]][,relevant_rows]
  sentixRaw[[i]] <- sentixRaw[[i]][order(sentixRaw[[i]][,1]),]
}
```

```
unlist(lapply(sentixRaw, nrow))
```

```
##      DAX      DAXm      TEC      TECm      ESX50      ESX50m      SP5      SP5m      NASDAQ
##      803      803      803      803      803      803      803      803      803
## NASDAQm  NIKKEI  NIKKEIm      BUND      BUNDm      TBOND      TBONDm
##      803      803      803      802      802      802      802
```

```
datesSentix <- unique(sentixRaw[[1]]$Datum)
for(i in names(sentixRaw)[2:length(sentixRaw)]){
  if(!(setequal(datesSentix, sentixRaw[[i]]$Datum)))
    stop("Sentix Data of different indices have not same dates. Handle manually.")
}
```

```
for(i in names(sentixRaw)){
  sentixRaw[[i]] <- unique(sentixRaw[[i]])
}
```

```
unlist(lapply(sentixRaw, nrow))
```

```
##      DAX      DAXm      TEC      TECm      ESX50      ESX50m      SP5      SP5m      NASDAQ
##      802      802      802      802      802      802      802      802      802
## NASDAQm  NIKKEI  NIKKEIm      BUND      BUNDm      TBOND      TBONDm
##      802      802      802      802      802      802      802
```

```
(dateMin <- min(datesSentix))

## [1] "2001-02-23"

(dateMax <- max(datesSentix))

## [1] "2016-09-02"

rm(folderSentix, sheets, relevant_rows, i)
detach("package:openxlsx", unload = T)
```

Stocks

We take data mainly from Yahoo Finance. We take closing course from *dateMin* to *dateMax* for several indexes and store in the data frame *stocks* the closing stock price at each date of the sentiment data (*datesSentix*).

We take the following as sources of the data:

- DAX *^GDAXI*
- TEC *^TECDAX*
- ESX50 *^STOXX50E*
- SP500 *^GSPC*
- NASDAQ *^NDX*
- NIKKEI *^N225*
- BUND from Sebastian: Den Bund-Future habe ich bei onvista in 5-Jahresstücken geladen und zusammengebaut. Dezimaltrennzeichen umgestellt im .csv — not from yahoo, manually from bundesbank *BBK01.WT0557*
- TBOND from Sebastian: Beim T-Bond ist es die 10 Year Treasury Note, auf welche das TBOND Sentiment abzielt. Diese habe ich bei FRED geladen: <https://fred.stlouisfed.org/series/DGS10>

```
# install.packages("quantmod")
library(quantmod)
```

```
## Loading required package: xts
## Loading required package: zoo
##
## Attaching package: 'zoo'
## The following objects are masked from 'package:base':
##
##      as.Date, as.Date.numeric
## Loading required package: TTR
## Version 0.4-0 included new data defaults. See ?getSymbols.
```

```
# ?getSymbols
```

```
stocks <- data.frame(Datum = datesSentix)

# DAX
dax <- new.env()
getSymbols("^GDAXI", env = dax, src = "yahoo", from = dateMin, to = dateMax)

## 'getSymbols' currently uses auto.assign=TRUE by default, but will
## use auto.assign=FALSE in 0.5-0. You will still be able to use
## 'loadSymbols' to automatically load data. getOption("getSymbols.env")
```

```

## and getOption("getSymbols.auto.assign") will still be checked for
## alternate defaults.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.warning4.0"=FALSE). See ?getSymbols for details.
##
## WARNING: There have been significant changes to Yahoo Finance data.
## Please see the Warning section of '?getSymbols.yahoo' for details.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.yahoo.warning"=FALSE).
##
## Warning: ^GDAXI contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
## [1] "GDAXI"
DAX <- data.frame(dax$GDAXI[datesSentix,"GDAXI.Close"])
colnames(DAX) <- "Close" # somehow the column name cannot be given directly
DAX$Datum <- as.Date(row.names(DAX))

stocks$DAX <- merge(stocks, DAX, by = "Datum", all.x = T)$Close

# TEC
tec <- new.env()
getSymbols("^TECDAX", env = tec, src = "yahoo", from = dateMin, to = dateMax)

## Warning: ^TECDAX contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
## [1] "TECDAX"
TEC <- data.frame(tec$TECDAX[datesSentix, "TECDAX.Close"])
colnames(TEC) <- "Close"
TEC$Datum <- as.Date(row.names(TEC))

stocks$TEC <- merge(stocks, TEC, by = "Datum", all.x = T)$Close

# ESX50
esx50 <- new.env()
getSymbols("^STOXX50E", env = esx50, src = "yahoo", from = dateMin, to = dateMax)

## Warning: ^STOXX50E contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
## [1] "STOXX50E"
ESX50 <- data.frame(esx50$STOXX50E[datesSentix,"STOXX50E.Close"])
colnames(ESX50) <- "Close"
ESX50$Datum <- as.Date(row.names(ESX50))

stocks$ESX50 <- merge(stocks, ESX50, by = "Datum", all.x = T)$Close

```

```
# SP500
sp500 <- new.env()
getSymbols("~GSPC", env = sp500, src = "yahoo", from = dateMin, to = dateMax)
```

```
## [1] "GSPC"
```

```
SP500 <- data.frame(sp500$GSPC[datesSentix,"GSPC.Close"])
colnames(SP500) <- "Close"
SP500$Datum <- as.Date(row.names(SP500))
# sum(is.na(SP500$Close))
```

```
stocks$SP5 <- merge(stocks, SP500, by = "Datum", all.x = T)$Close
```

```
# NASDAQ
nasdaq <- new.env()
getSymbols("~NDX", env = nasdaq, src = "yahoo", from = dateMin, to = dateMax)
```

```
## [1] "NDX"
```

```
NASDAQ <- data.frame(nasdaq$NDX[datesSentix,"NDX.Close"])
# sum(is.na(NASDAQ[, "NDX.Close"]))
colnames(NASDAQ) <- "Close"
NASDAQ$Datum <- as.Date(row.names(NASDAQ))
```

```
stocks$NASDAQ <- merge(stocks, NASDAQ, by = "Datum", all.x = T)$Close
```

```
# NIKKEI
nikkei <- new.env()
getSymbols("~N225", env = nikkei, src = "yahoo", from = dateMin, to = dateMax)
```

```
## Warning: ^N225 contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
```

```
## [1] "N225"
```

```
NIKKEI <- data.frame(nikkei$N225[datesSentix,"N225.Close"])
colnames(NIKKEI) <- "Close"
NIKKEI$Datum <- as.Date(row.names(NIKKEI))
```

```
stocks$NIKKEI <- merge(stocks, NIKKEI, by = "Datum", all.x = T)$Close
```

Bund

```
BUND <- read.csv(file.path(folderData, "Bundfuture", "Bundfuture2001-2017.csv"), sep = ";")
BUND[,1] <- as.Date(BUND[,1], format = "%d.%m.%Y")
BUND <- BUND[BUND[,1] %in% datesSentix,]
BUND <- as.data.frame(BUND)
```

```
stocks$BUND <- merge(stocks, BUND, by = "Datum", all.x = T)$Schluss
```

Treasury bond

```

TBOND <- read.csv(file.path(folderData, "10 year T-Notes", "DGS10.csv"), sep = ",")
TBOND[,1] <- as.Date(TBOND[,1], format = "%Y-%m-%d")
TBOND[,2] <- as.numeric(as.character(TBOND[,2])) # was a factor first and factors are stored via index

## Warning: NAs durch Umwandlung erzeugt

colnames(TBOND) <- c("Datum", "DGS10")
TBOND <- TBOND[TBOND[,1] %in% datesSentix,]
TBOND <- as.data.frame(TBOND)

stocks$TBOND <- merge(stocks, TBOND, by = "Datum", all.x = T)$DGS10

rm(BUND, DAX, ESX50, NASDAQ, NIKKEI, SP500, TBOND, TEC,
    dax, esx50, nasdaq, nikkei, sp500, tec, i)

## Warning in rm(BUND, DAX, ESX50, NASDAQ, NIKKEI, SP500, TBOND, TEC, dax, :
## Objekt 'i' nicht gefunden

```

Data Preparation

We look at how many people participated in the survey on average and remove TBOND.

We look at the number of dates on which not all stocks report prices and remove those to end up with the dates on which all data is available *datesAll*.

Sentix - number of participants in survey

```
cols <- 8:10
colnames(sentixRaw[[1]])[cols]

## [1] "G+" "Gn" "G-"
unlist(lapply(sentixRaw, function(x) {round(mean(rowSums(x[cols])), 0)}))

##      DAX      DAXm      TEC      TECm      ESX50      ESX50m      SP5      SP5m      NASDAQ
##      701      698      677      674      696      692      694      690      683
## NASDAQm  NIKKEI  NIKKEIm      BUND      BUNDm      TBOND      TBONDm
##      680      647      643      628      625      160      160

rm(cols)
```

We remove TBOND, as just very few people voted for it over time in comparison to the other indices.

```
sentixRaw[["TBOND"]] <- NULL
sentixRaw[["TBONDm"]] <- NULL
stocks <- stocks[,~which(colnames(stocks)=="TBOND")]

unlist(lapply(sentixRaw, function(x) {sum(is.na.data.frame(x))}))

##      DAX      DAXm      TEC      TECm      ESX50      ESX50m      SP5      SP5m      NASDAQ
##      0      0      0      0      0      0      0      0      0
## NASDAQm  NIKKEI  NIKKEIm      BUND      BUNDm
##      0      0      0      0      0
```

Stocks - na's

There might be dates missing (we just have to look at stocks as we found the *datesSentix* as those dates, for which all sentiment is there).

```
colSums(is.na.data.frame(stocks))

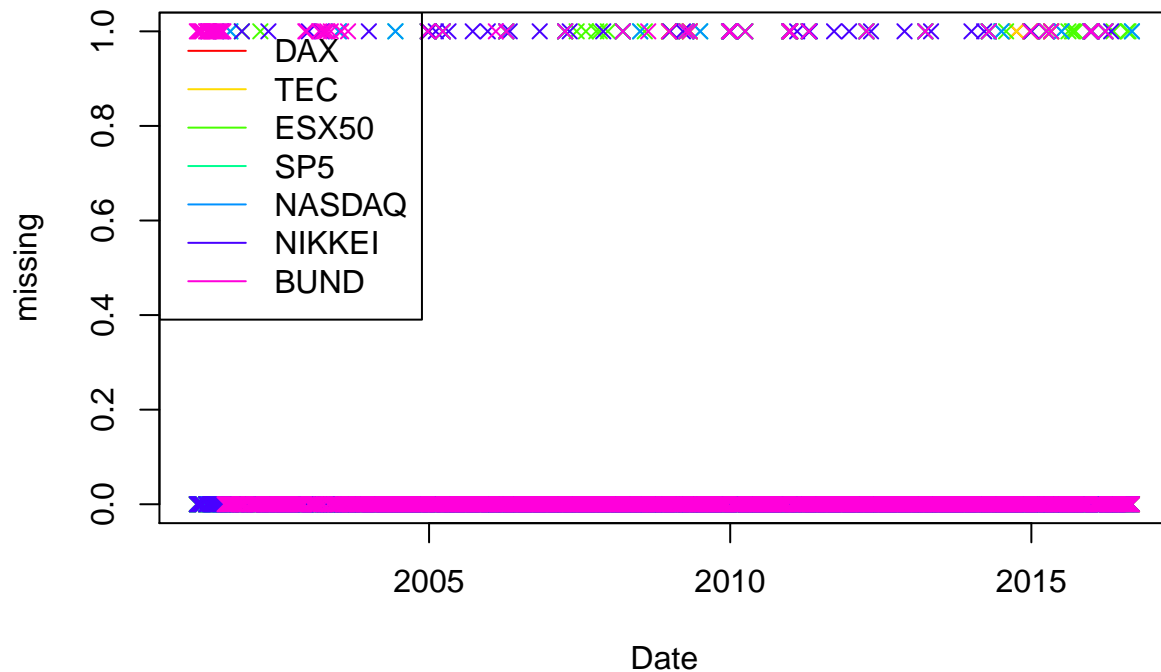
## Datum      DAX      TEC      ESX50      SP5      NASDAQ      NIKKEI      BUND
##      0      25      22      41      26      26      32      56
```

Visualize the missing dates (missing date = 1, not missing date = 0 on y-axis).

```
cols <- rainbow(ncol(stocks)-1)

plot(stocks[,1], is.na(stocks[,2]), main = "Missing Dates", ylab = "missing", xlab = "Date", col = cols)
for(i in 2:(ncol(stocks)-1)){
  par(new=T)
  plot(stocks[,1], is.na(stocks[,i+1]), col = cols[i], axes = F, xlab = "", ylab = "", pch = 4)
}
legend("topleft", legend = colnames(stocks)[2:ncol(stocks)], col = cols, lty = 1)
```

Missing Dates



```
rm(cols, i)
```

Determine, how many dates do have all data available.

```
nrow(stocks)
```

```
## [1] 802
```

```
nrow(stocks[complete.cases(stocks),])
```

```
## [1] 695
```

```
nrow(stocks) - nrow(stocks[complete.cases(stocks),])
```

```
## [1] 107
```

```
(nrow(stocks) - nrow(stocks[complete.cases(stocks),]))/nrow(stocks)
```

```
## [1] 0.1334165
```

So we would delete 13.3416459 % of the data.

delete

We delete dates with missing values.

```
stocks <- stocks[complete.cases(stocks),]
```

```
datesAll <- stocks[,1]
```

```
rm(datesSentix)
```

```
sentixRaw <- lapply(sentixRaw, function(x) {x[(x[,1] %in% datesAll),]})
unlist(lapply(sentixRaw, nrow))
```

```
##      DAX      DAXm      TEC      TECm      ESX50      ESX50m      SP5      SP5m      NASDAQ
##      695      695      695      695      695      695      695      695      695
## NASDAQm  NIKKEI  NIKKEIm      BUND      BUNDm
##      695      695      695      695      695
```

approach

One way of approaching this might be via linear regression of the stock data when no stock price is available. but this assumes a linear relationship and might cause trouble.