

# Illustrating diversification using OBX shares

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## OBX shares - 25 large Norwegian companies - Sep '22

Company	MNEMO	Sector (ICB)	Weight (%)
EQUINOR	EQNR	Energy	31.45
DNB BANK	DNB	Financials	12.80
AKER BP	AKRBP	Energy	7.87
NORSK HYDRO	NHY	Basic Materials	6.30
YARA INTERNATIONAL	YAR	Basic Materials	5.05
TELENOR	TEL	Telecommunications	5.00
MOWI	MOWI	Consumer Staples	4.85
ORKLA	ORK	Consumer Staples	4.74
TOMRA SYSTEMS	TOM	Industrials	3.63
STOREBRAND	STB	Financials	2.84
KONGSBERG GRUPPEN	KOG	Industrials	2.34
NORDIC SEMICONDUCTOR	NOD	Technology	2.01
SALMAR	SALM	Consumer Staples	1.72
SUBSEA 7	SUBC	Energy	1.55
NEL	NEL	Energy	1.51
VÅR ENERGI	VAR	Energy	1.06
AUTOSTORE HOLDINGS	AUTO	Industrials	0.98
SCHIBSTED SER. A	SCHA	Technology	0.86
FRONTLINE	FRO	Industrials	0.85

## Reading the OBX stocks history

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```
library(quantmod)
symbols <- read.table(".././misc/obx.txt",header=FALSE)
names(symbols) <- "symbols" # list with index constituents
started <- FALSE
all_obx_returns <- NULL
for (i in 1:nrow(symbols)){
  symbol <- trimws(symbols[i,1]) # the first date (fdaet) needs to be defined
  data <- getSymbols(symbol, source="yahoo", auto.assign=FALSE, from=fd
  daily_prices <- na.omit(data[,6])
  monthly_returns <- monthlyReturn(daily_prices)
  names(monthly_returns) <- symbol
  index(monthly_returns) <- as.yearmon(index(monthly_returns))
  if (nrow(monthly_returns)>1) {
    if (!started){
      all_obx_returns <- monthly_returns
      started <- TRUE
    }
    else {
      all_obx_returns <- merge(all_obx_returns,monthly_returns,all=TRUE
    }
  }
}
```

10

20

## Correlation structure

Using monthly returns for the 15 largest OBX shares for the period 2015–2022, calculate the correlation matrix of the returns.

```
fdate <- as.Date("2015-01-01")
ldate <- as.Date("2022-12-31")
source("../2023_01_read_data/read_obx_stocks.R")
all_obx_returns <- window(all_obx_returns,
                           start=as.yearmon(fdate),
                           end=as.yearmon(ldate))
CorrMat <- cor(all_obx_returns,use="pairwise.complete.obs")
CorrMat[upper.tri(CorrMat,diag=TRUE)]<-NA
outdir <- "../..../results/2023_01_correlation_matrix/"
ofilename <- paste0(outdir,"corr_matr_15.tex")
print(xtable(CorrMat[1:15,1:15]),file=ofilename)
```

## Correlation structure

	EQNR	DNB	AKRBP	NHY	YAR	TEL	MOWI	ORK	TOM	STB
DNB	0.48									
AKRBP	0.64	0.57								
NHY	0.43	0.45	0.35							
YAR	0.33	0.50	0.25	0.45						
TEL	-0.08	0.09	-0.03	-0.09	0.14					
MOWI	0.18	0.33	0.30	0.31	0.13	0.06				
ORK	-0.08	-0.20	-0.23	-0.13	-0.04	0.21	0.04			
TOM	0.12	0.10	0.12	0.07	0.00	-0.03	0.04	0.21		
STB	0.37	0.71	0.53	0.52	0.30	0.00	0.36	-0.11	0.07	
KOG	0.11	0.32	0.16	0.26	0.15	0.05	0.24	-0.11	0.04	0.22
NOD	0.22	0.42	0.18	0.38	0.25	0.14	0.08	-0.01	0.33	0.31
SALM	0.08	0.12	0.13	0.08	-0.07	0.02	0.77	0.20	0.11	0.15
SUBC	0.61	0.59	0.73	0.47	0.36	-0.05	0.25	-0.23	0.10	0.49
NEL	-0.01	0.11	0.09	0.15	0.09	-0.12	0.06	-0.06	0.28	0.28

Correlation matrix 15 largest OBX stocks

# Constructing the mean variance set

## **Exercise**

Using historical monthly returns for OBX in the period 2015 to 2022 to estimate means and covariances, illustrate the mean-variance frontier constructed using respectively

1. the five largest shares in the OBX index.
2. the fifteen largest shares in the OBX index.

To do this, need to pull price series for the OBX shares, calculate returns, pick the returns in the given window, and estimate means and variances.

First, the average returns over the period

## Average returns 15 largest OBX shares, 2015–2022

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EQNR.OL	19.3
DNB.OL	15.4
AKRBP.OL	39.0
NHY.OL	16.8
YAR.OL	11.2
TEL.OL	1.3
MOWI.OL	12.9
ORK.OL	10.4
TOM.OL	28.4
STB.OL	21.4
KOG.OL	23.8
NOD.OL	23.5
SALM.OL	24.6
SUBC.OL	14.8
NEL.OL	51.4

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Returns are annualized, and in percent.



## Mean variance frontiers

