1 Constructing Portfolio Returns

A standard topic in finance applications is the construction of a portfolio of assets, and measuring its return.

As an example, suppose we have a bunch of tickers, and we want to construct a portfolio of these assets. The concrete example is a few Norwegian stocks: GENT.OL, EPIC.OL, AXXIS.OL, MPCC.OL, GRONG.OL and JPK.OL. For the post-2010 period, we want to construct the return of an equally weighted portfolio of these stocks at a monthly frequency.

This is done by getting the prices of these assets, using yahoo finance (or some other source), calculating monthly returns for each asset, and calculating the average return.

Some care is necessary, there may be missing observations, so one needs to calculate the average removing missing observations.

The following is the main logic (in `R`) for a routine that does this.

```
library(quantmod)
mean_cut_na <- function(x) { mean(na.omit(x))}
length_cut_na <- function(x) { length(na.omit(x))}

returns<-NULL

for (i in 1:length(rics)){
    data <- getSymbols(rics[i],auto.assign=FALSE,from=first_date)
    if (length(data)>0){
        prices <- data[,6]
        r <- monthlyReturn(prices)
        index(r) <- as.yearmon(index(r))
        names(r) <- rics[i]
        if (length(r)>0){
            if (length(returns)<1){
                returns <- r
            }
            else {
                returns <- merge(returns,r)
            }
        }
    }
}
avg_ret <- apply(returns,1,mean_cut_na)
avg_ret <- xts(avg_ret,order.by=index(returns))
names(avg_ret) <- "avg_ret"
no_obs <- apply(returns,1,length_cut_na)
no_obs <- xts(no_obs,order.by=index(returns))
names(no_obs) <- "no_obs"
```

Some comments: First is defined functions for calculating means and number of observations removing missing observations.

The data is collected directly from yahoo finance using the `getSymbols` routine in the `quantmod` library. The routine loops over all identifiers. For each stock, if it returns data, use the `monthlyReturn` function (also from `quantmod`) to calculate monthly returns (which is returned as a `xts` object). The returns are collected into an xts object, indexed by months (using the `yearmon` type of date index, to avoid issues with the last observation each month not matching exactly on the date).

The average return each month is calulated across all stocks without missing returns.

How many stocks are actually in the portfolio each month is calculated separately.

Before the above routine is called, need to specify the list of identifiers (`rics`), and the first date (`first_date`).

```
library(xtable)
rics <- c("GENT.OL",
          "EPIC.OL",
          "AXXIS.OL",
          "MPCC.OL",
          "GRONG.OL",
          "JPK.OL")
first_date <- as.Date("2010-01-01")
source("ew_portfolio_calc.R")
head(returns)
tabl <- xtable(merge(100*returns,100*avg_ret,no_obs),
               digits=c(0,2,2,2,2,2,2,2,0))
print(tabl)
```

To show the results, this is the first few observations (returns in percent):

	GENT.OL	EPIC.OL	AXXIS.OL	MPCC.OL	GRONG.OL	JPK.OL	avg_ret	no_obs
Dec 2016	103.85		8.48				56.16	2
Jan 2017	-18.87	4.62	3.22				-3.68	3
Feb 2017	11.16	-8.09	-4.23				-0.39	3
Mar 2017	4.60	16.00	4.42				8.34	3
Apr 2017	-2.00	3.45	-0.89				0.19	3
May 2017	-4.29	0.00	-10.56	0.00			-3.71	4
Jun 2017	-4.05	-10.00	-2.01	0.00	2.34		-2.74	5
Jul 2017	8.89	-25.93	-2.56	6.82	-1.37		-2.83	5
Aug 2017	-2.04	10.00	13.68	0.00	-0.93		4.14	5
Sep 2017	-5.21	-5.45	-3.47	0.00	-2.80		-3.39	5
Oct 2017	-9.89	-22.21	2.64	4.26	4.81		-4.08	5
Nov 2017	5.61	11.37	1.64	0.00	-0.46	1.69	3.31	6
Dec 2017	-5.31	22.64	-2.99	4.08	-0.46	0.00	2.99	6
Jan 2018	2.44	21.27	1.42	1.96	1.85	0.00	4.82	6
Feb 2018	0.00	-4.48	2.80	-0.96	0.91	0.00	-0.29	6

Note that these companies were listed on the OSE starting late in 2016, so there are a few missing observations at the beginning.