Rolling Estimation of Efficient Portfolios

Amath 462/Econ 424
Eric Zivot
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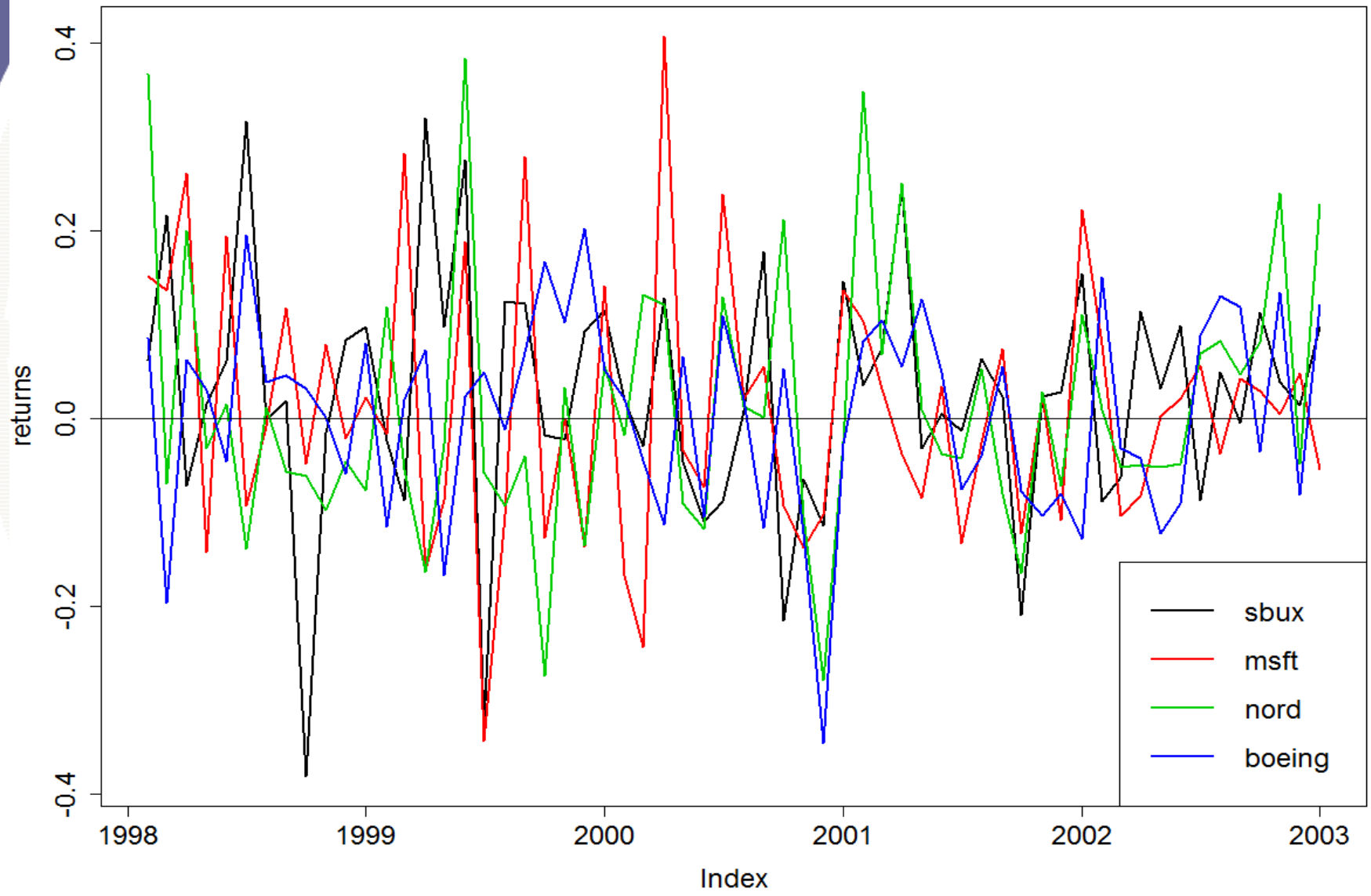
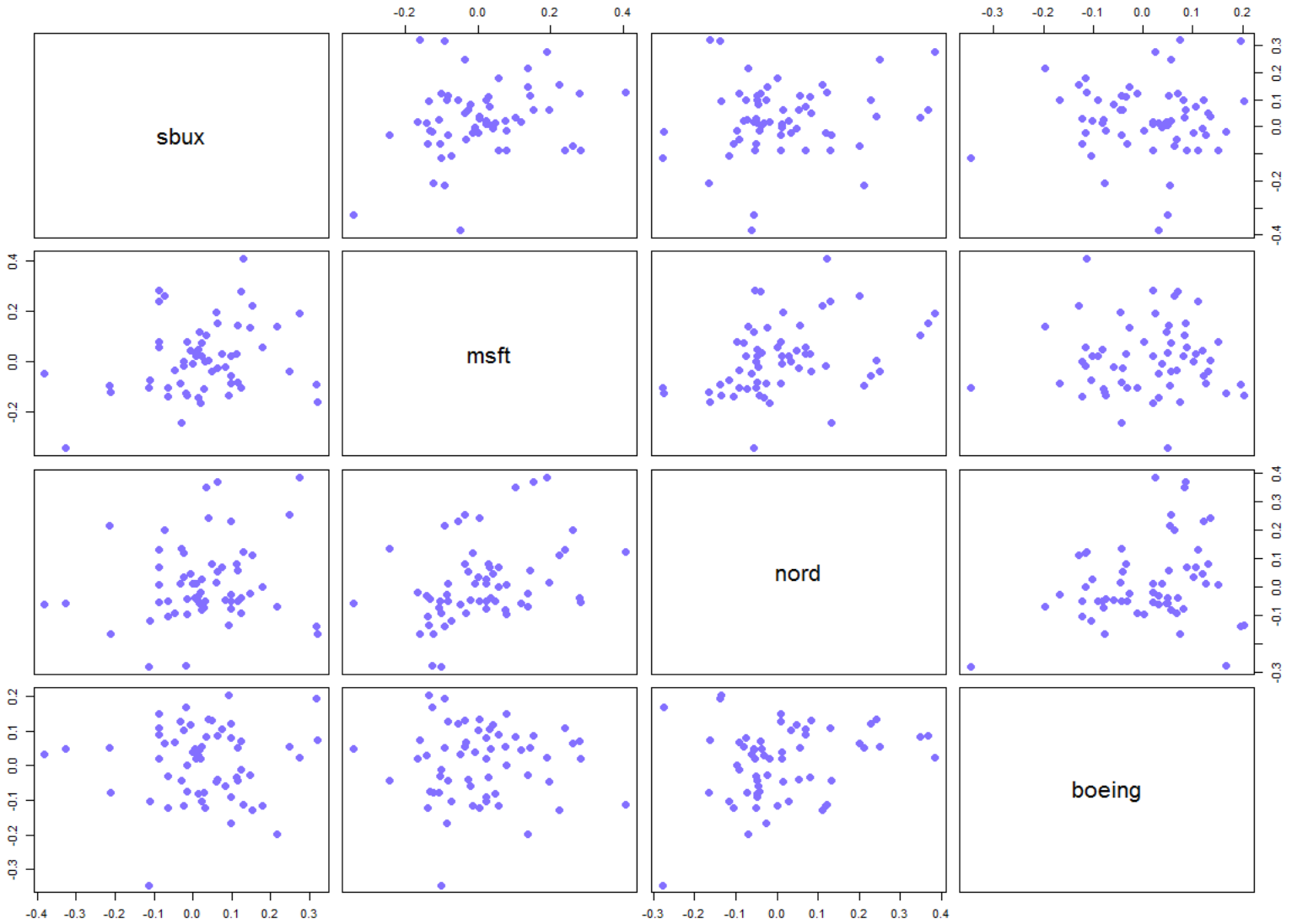
Example Data on Four Stocks



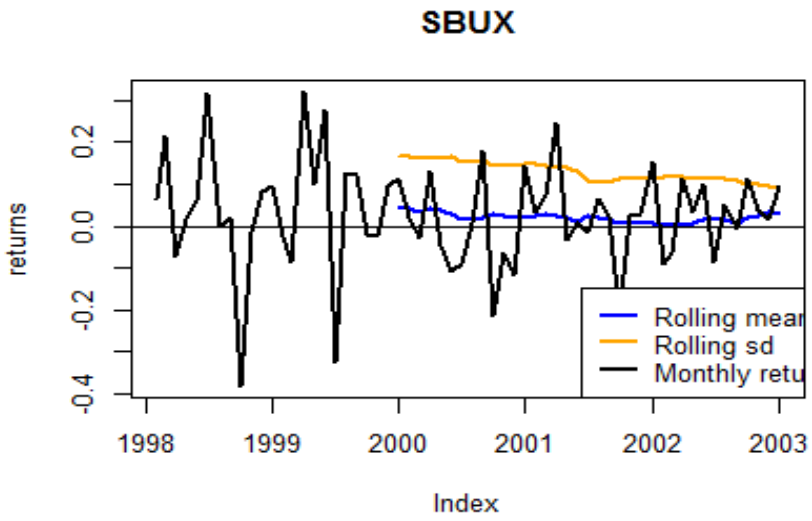
Example Data on Four Stocks

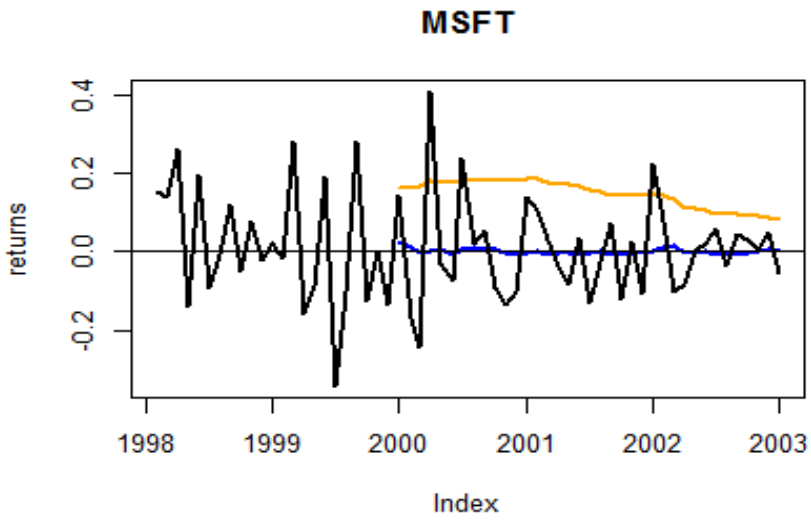


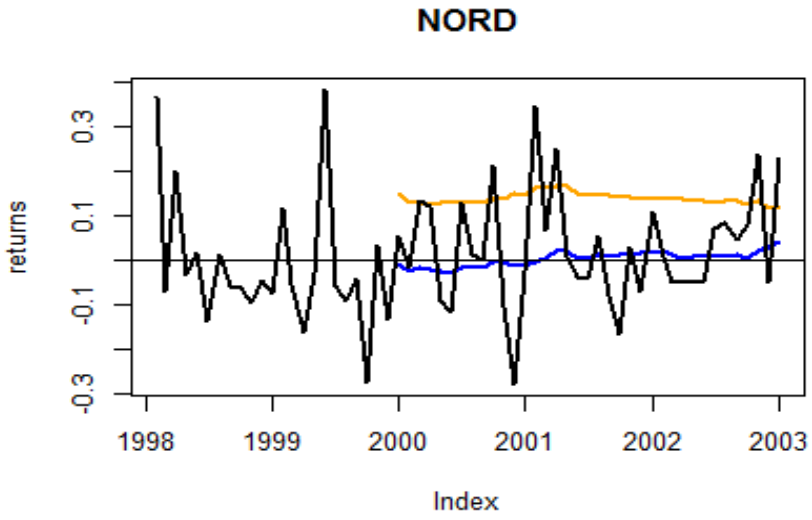
Estimated Inputs: Full Sample

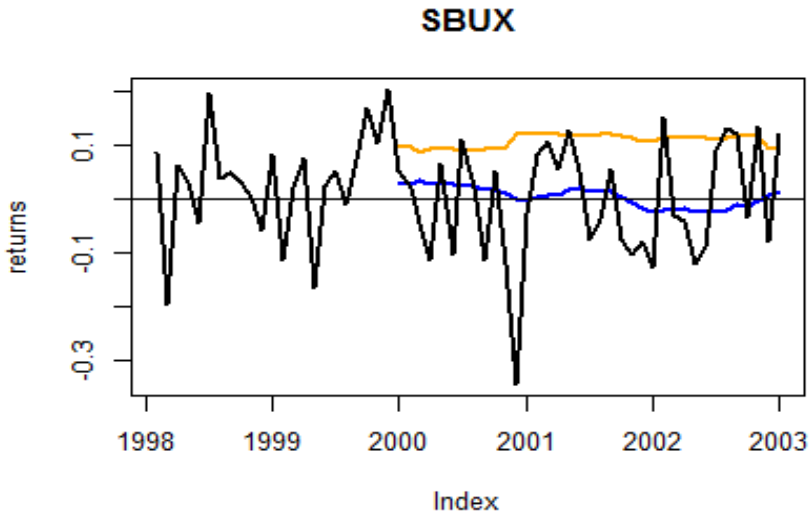
```
# estimated means
> mu.hat
     sbux      msft      nord    boeing
0.026753 0.009256 0.012024 0.007423

# estimated sds
> sd.hat
   sbux    msft    nord boeing
0.1305 0.1391 0.1375 0.1051

# estimated correlations
> cor.hat
           sbux      msft   nord     boeing
sbux    1.00000  0.253079 0.1533  0.016126
msft    0.25308  1.000000 0.3775 -0.006234
nord    0.15327  0.377483 1.0000  0.233900
boeing 0.01613 -0.006234 0.2339  1.000000
```

24-Month Rolling Means and Std Devs

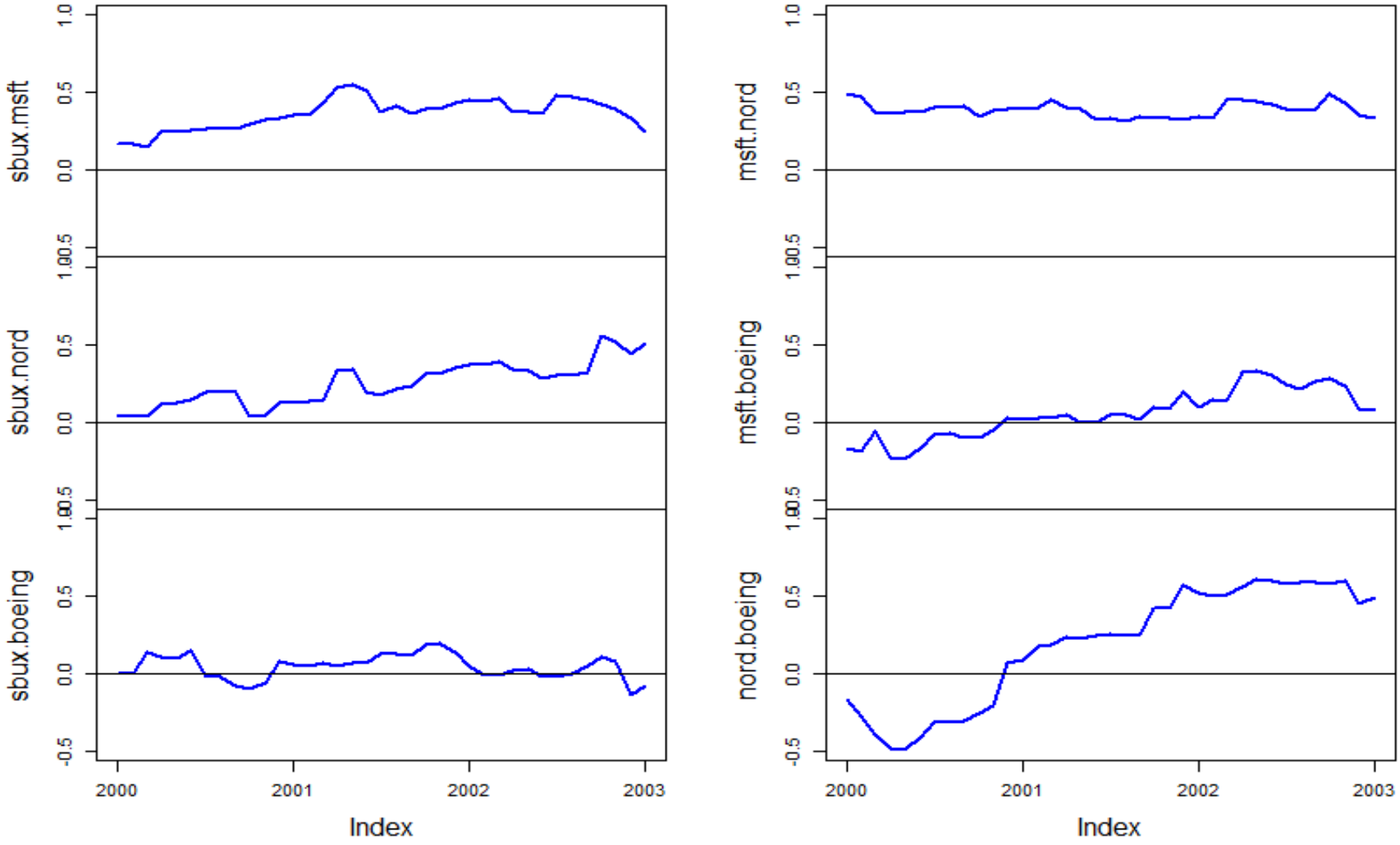








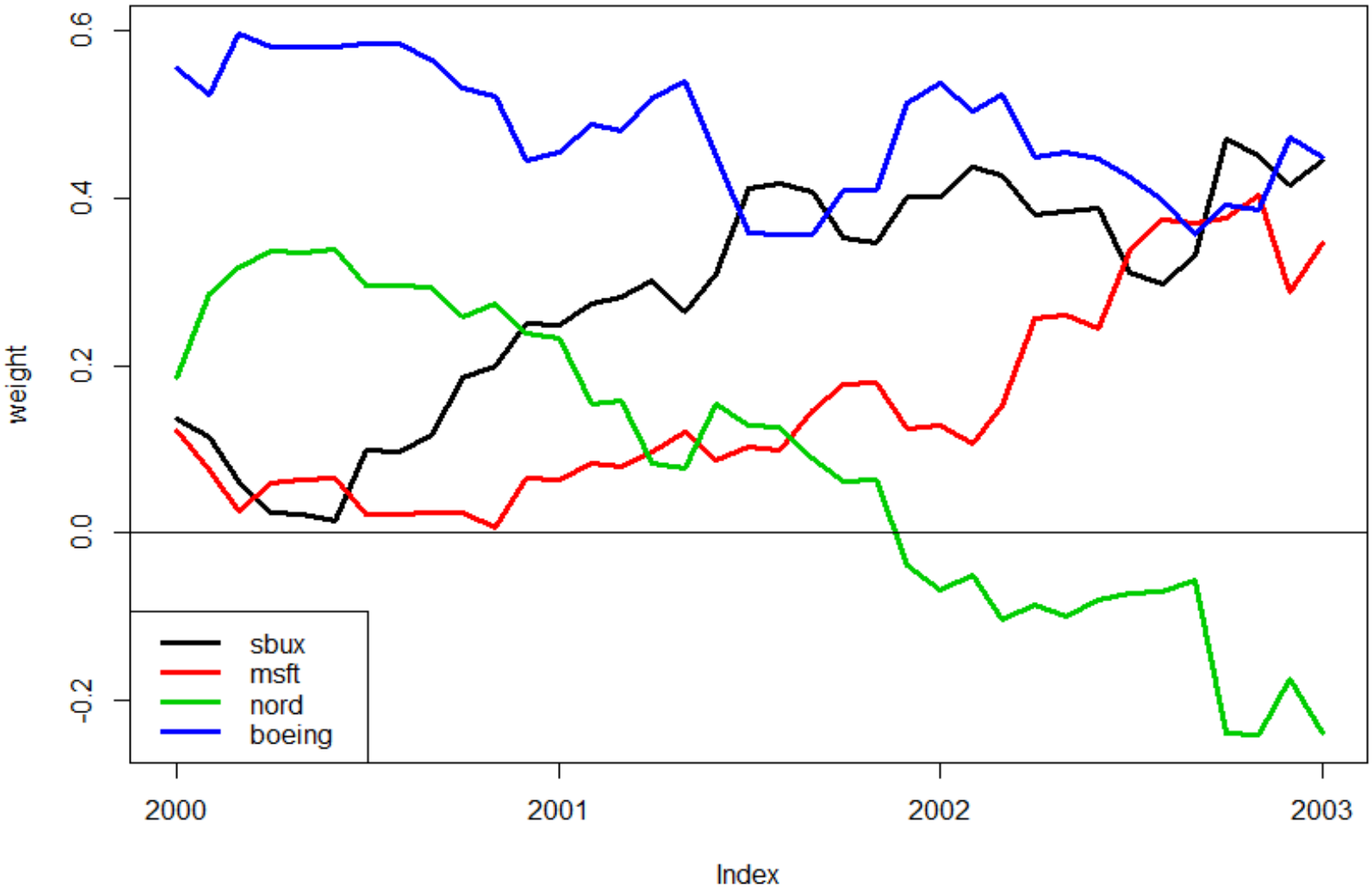
24-Month Rolling Correlations



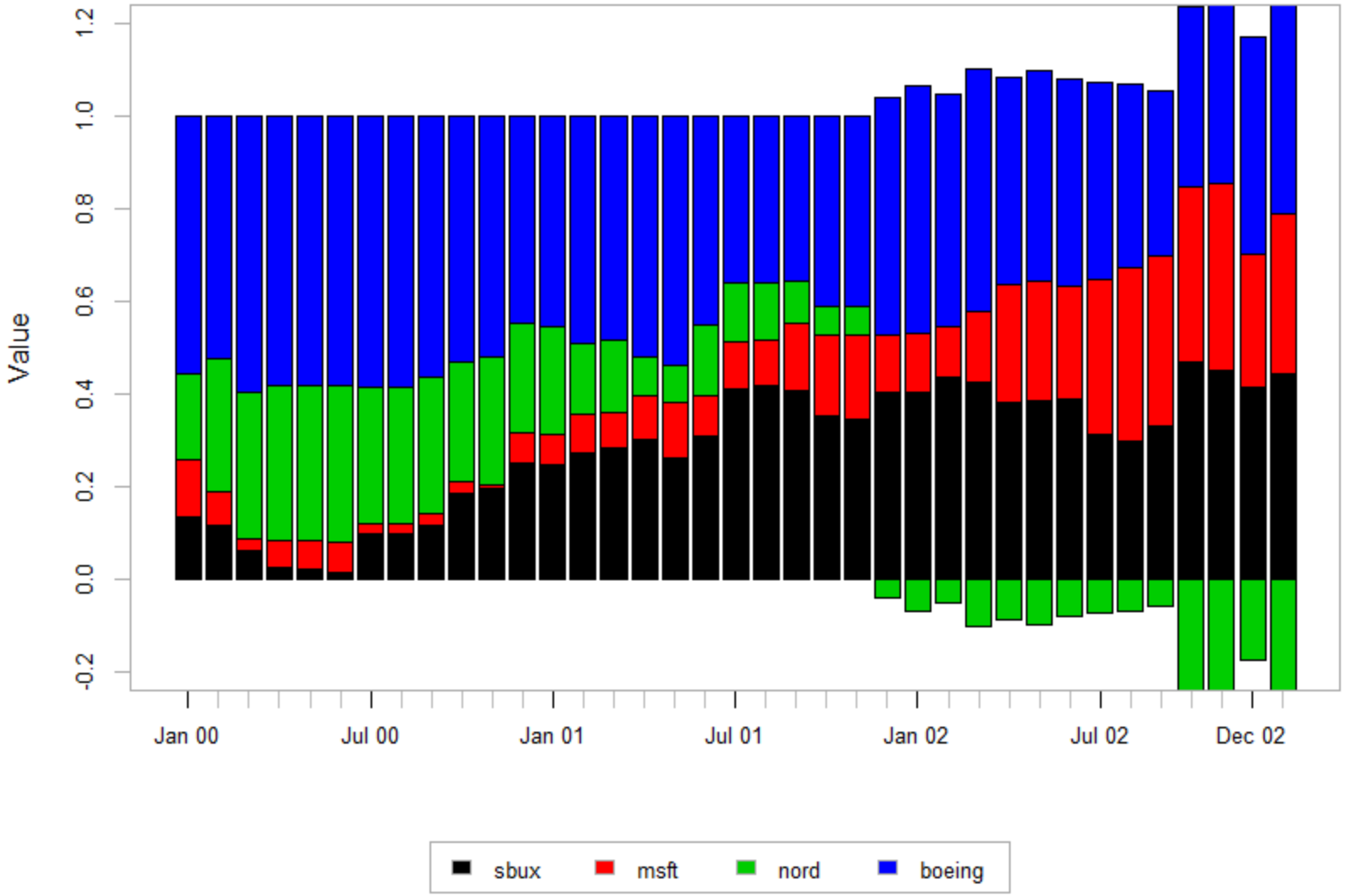
Rolling Global Minimum Variance Portfolio

```
rollGmin = function(x) {
        mu.hat = colMeans(x)
        cov.hat = var(x)
        gmin = globalMin.portfolio(er=mu.hat,
                                   cov.mat=cov.hat)
        ans = c(gmin$er,gmin$sd,gmin$weights)
        names(ans)[1:2] = c("er","sd")
        return(ans)
}

# rolling 24-month global minimum variance portfolios
> roll.gmin = rollapply(ret.z, width=24,
+                       by.column=FALSE, align="right",
+                       FUN=rollGmin)
> colnames(roll.gmin)
[1] "er"   "sd"     "sbux"   "msft"   "nord"   "boeing"
```

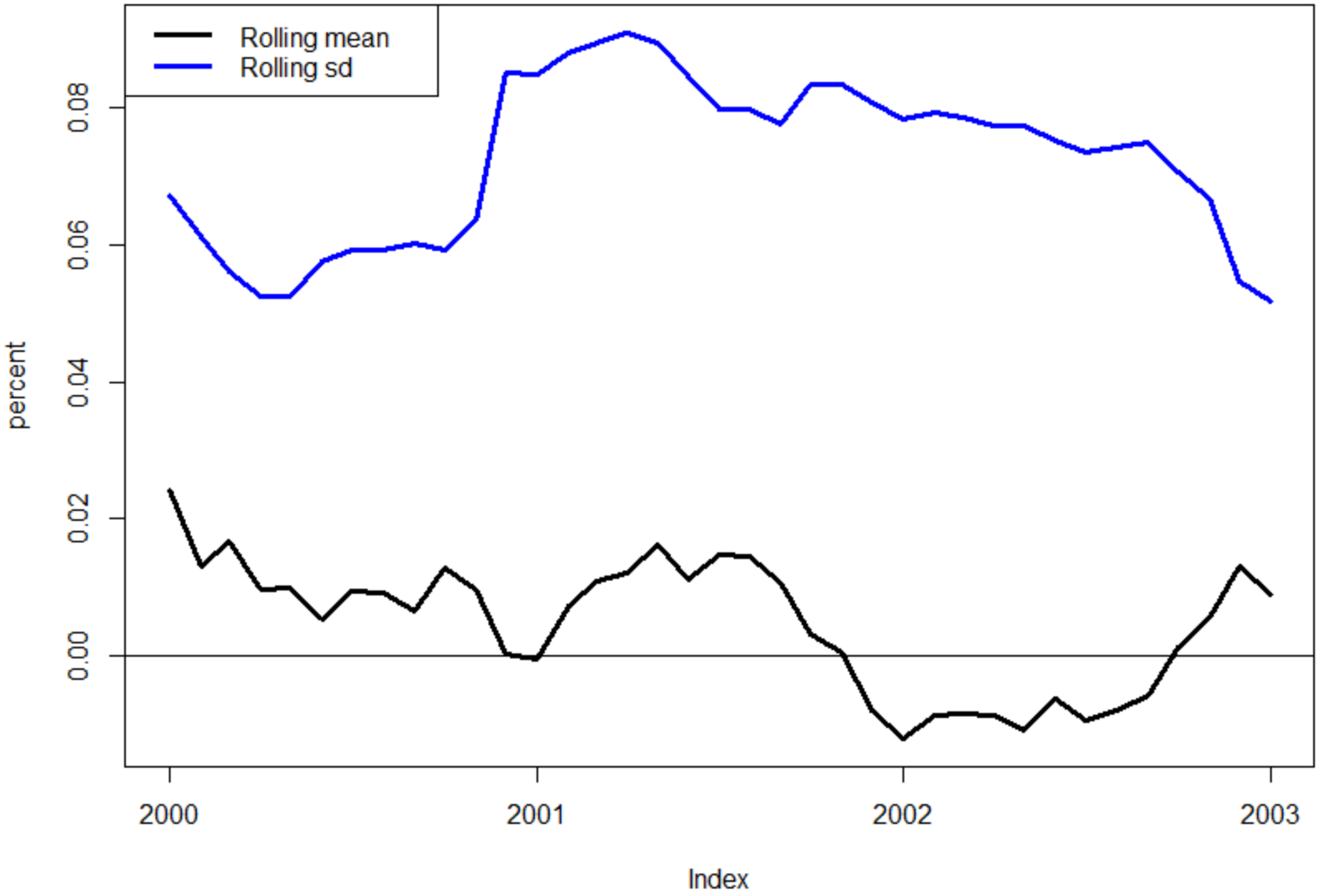
24-Month Rolling Weights



24-Month Rolling Weights



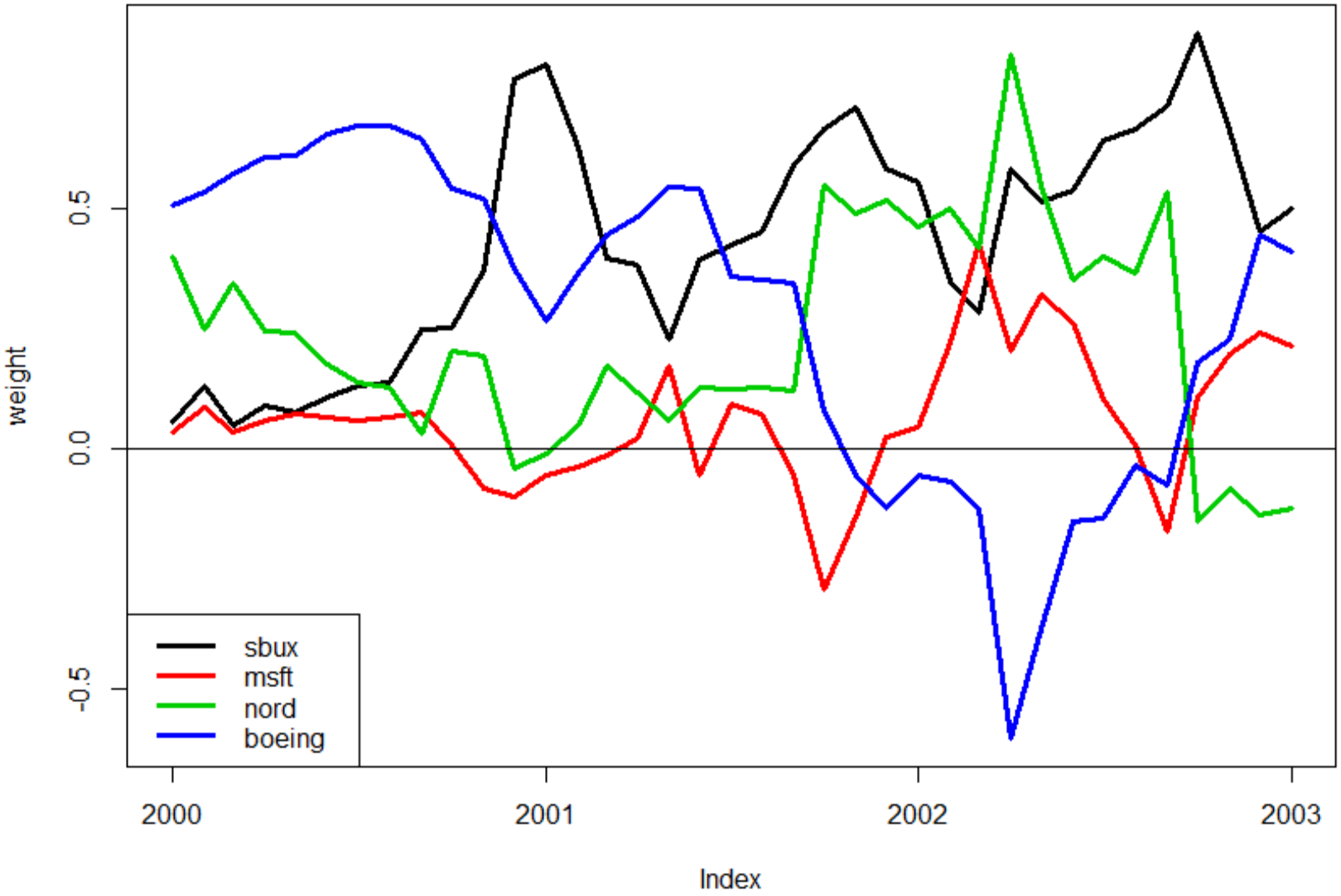
24-Month Rolling Means and Std Devs



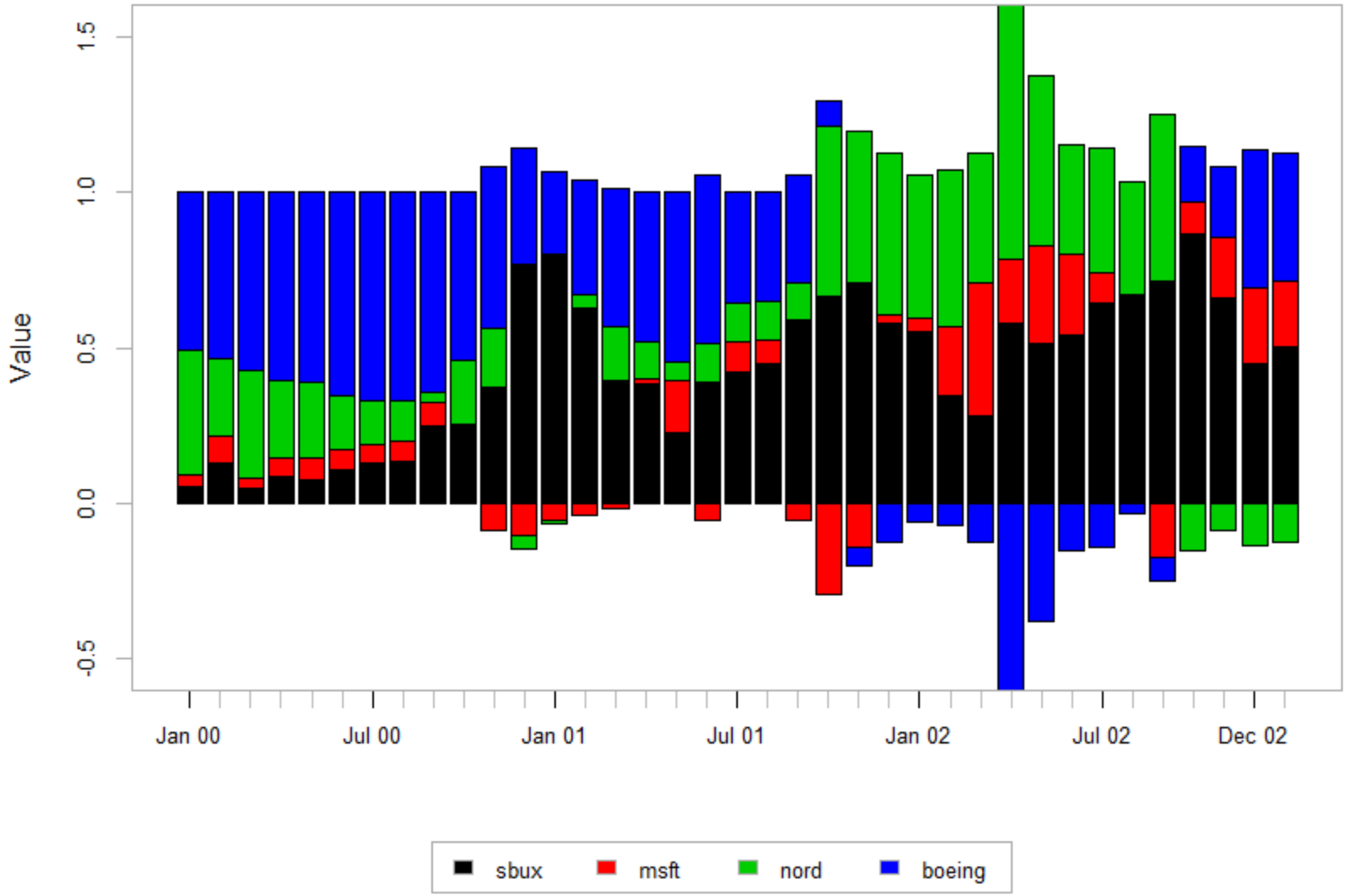
Rolling Efficient Portfolio with $\mu_p = 0.015$

```
rollefficient = function(x,target=0.015) {
      mu.hat = colMeans(x)
      cov.hat = var(x)
      eport = efficient.portfolio(er=mu.hat,
                                  cov.mat=cov.hat,
                                  target.return=target)
      ans = c(eport$er,eport$sd,eport$weights)
      names(ans)[1:2] = c("er","sd")
      return(ans)
}

# rolling efficient portfolios with target = 0.015
> roll.eport = rollapply(ret.z, width=24,
+                        by.column=F,align="right",
+                        FUN=rollefficient)
> colnames(roll.eport)
[1] "er"    "sd"    "sbux"   "msft"   "nord"   "boeing"
```

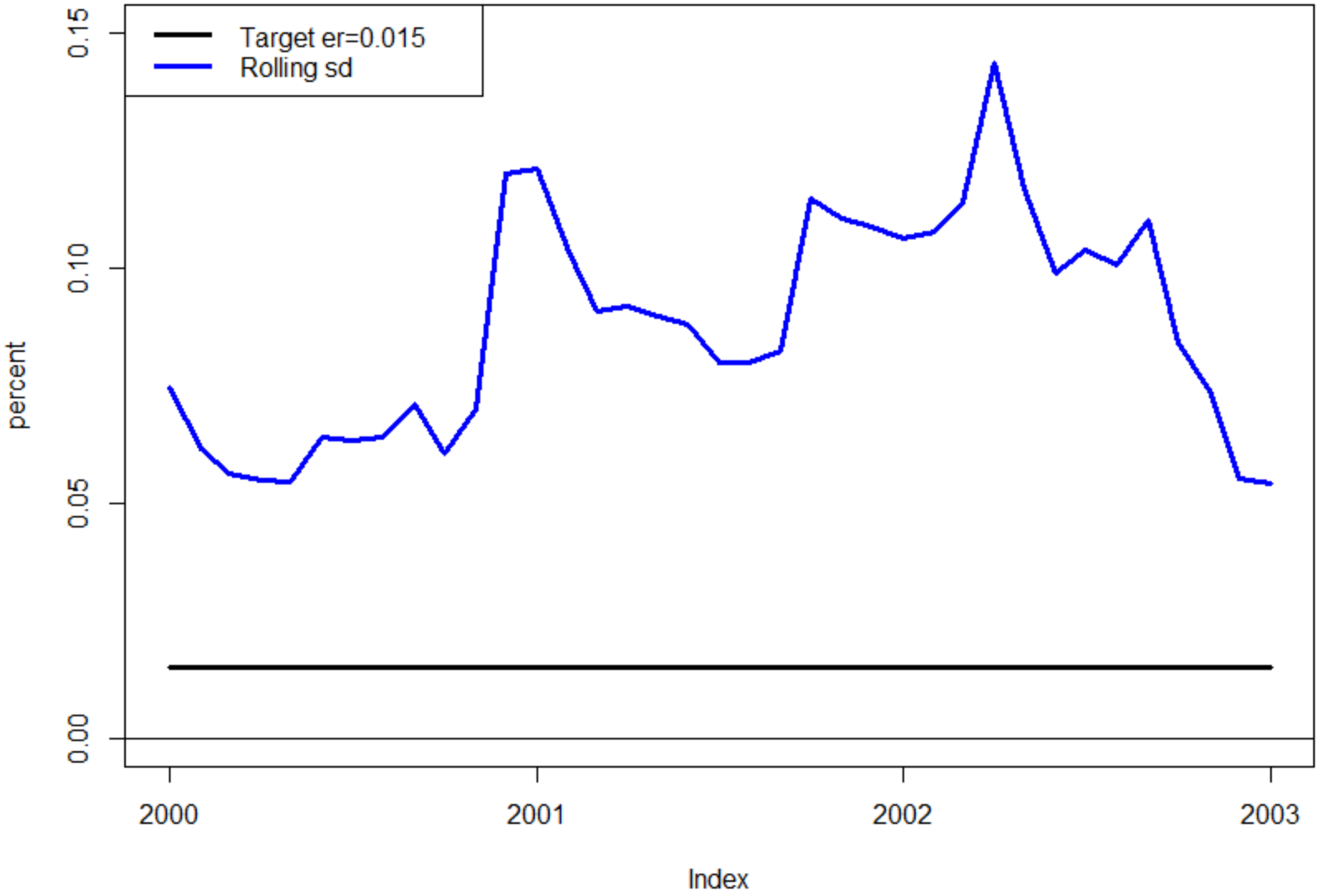
24-Month Rolling Weights



24-Month Rolling Weights



24-Month Rolling SD on Efficient Portfolio



Summary of Results

- Changing means, standard deviations and correlations imply changing weights, means and standard deviations of efficient portfolios
- Efficient portfolios must be rebalanced as inputs change over time
- How often to rebalance is not straightforward to determine