Risk-Adjusted Perfomance

Hypothetical Portfolio of AMZN, TSLA, IBM & MSFT

Indices: SPX / SPY

```r
names <- c("AMZN", "MSFT", "TSLA", "IBM")
date.from <- "2010-12-31"; date.to <- "2013-12-31"

getMonthlyReturns <- function(name, from = date.from, to = date.to) {
   prices <- getSymbols(name, from = date.from, to = date.to, auto.assign = F)
   monthly <- to.monthly(prices)
   returns <- Delt(monthly[, 6])[-1]

   ret.data <- data.table(Month = index(returns), Company = name, Return = returns[, 1])
   colnames(ret.data) <- c("Month", "Company", "Return")

   return(ret.data)
}

returns <- data.table::rbindlist(lapply(names, getMonthlyReturns))
```

```
'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.
```

```r
portfolio <- dcast(returns, Month ~ Company, value.var = c("Return"))

port.return <- data.table(Month = portfolio$Month, Return = rowMeans(portfolio[, 2:4]))[, .(Mor

indices <- c("SPY", "^GSPC")

index.returns <- data.table::rbindlist(lapply(indices, getMonthlyReturns))

combined <- rbind(port.return, index.returns)

consolidated <- dcast(combined, Month ~ Company, value.var = c("Return"))
colnames(consolidated) <- c("Month", "Portfolio", "SPY", "SPX")

consolidated
```

Month	Portfolio	SPY	SPX

```
 1: Jan 2011   0.0132794123   0.0233002583   0.022645574
 2: Feb 2011  -0.0036913993   0.0347372602   0.031956564
 3: Mar 2011   0.0006840647   0.0001199932  -0.001047313
 4: Apr 2011   0.0513253768   0.0289616521   0.028495380
 5: May 2011  -0.0098445165  -0.0112146065  -0.013500953
 6: Jun 2011   0.0315833871  -0.0168698174  -0.018257461
 7: Jul 2011   0.0673526326  -0.0200045417  -0.021474426
 8: Aug 2011  -0.0354580712  -0.0549754676  -0.056791107
 9: Sep 2011  -0.0141406939  -0.0694207775  -0.071761988
10: Oct 2011   0.0377137981   0.1091471135   0.107723039
11: Nov 2011  -0.0364122562  -0.0040636973  -0.005058715
12: Dec 2011  -0.0356187107   0.0104483041   0.008532764
13: Jan 2012   0.1027408082   0.0463745280   0.043583062
14: Feb 2012   0.0104923704   0.0434054187   0.040589464
15: Mar 2012   0.0679901798   0.0321638794   0.031332315
16: Apr 2012   0.0433881906  -0.0066756896  -0.007497453
17: May 2012  -0.0762875615  -0.0600557700  -0.062650726
18: Jun 2012   0.0447912002   0.0405812101   0.039554982
19: Jul 2012  -0.0042968287   0.0118291411   0.012597574
20: Aug 2012   0.0384608969   0.0250528087   0.019763370
21: Sep 2012   0.0182133896   0.0253507844   0.024236154
22: Oct 2012  -0.0625128777  -0.0181979852  -0.019789410
23: Nov 2012   0.0013367371   0.0056596035   0.002846717
24: Dec 2012   0.0021619407   0.0089345059   0.007068230
25: Jan 2013   0.0487211236   0.0511902009   0.050428097
26: Feb 2013   0.0032114708   0.0127587378   0.011060649
27: Mar 2013   0.0332097537   0.0379712164   0.035987724
28: Apr 2013   0.0196372581   0.0192125303   0.018085768
29: May 2013   0.0514266848   0.0236095484   0.020762812
30: Jun 2013  -0.0200225169  -0.0133446681  -0.014999302
31: Jul 2013   0.0090428675   0.0516773070   0.049462080
32: Aug 2013  -0.0238695484  -0.0299925500  -0.031298019
33: Sep 2013   0.0416831168   0.0316463533   0.029749523
34: Oct 2013   0.0653793902   0.0463065065   0.044595753
35: Nov 2013   0.0580907722   0.0296378781   0.028049472
36: Dec 2013   0.0049302797   0.0210940363   0.019525801
        Month     Portfolio          SPY           SPX
```

```
ggplot(melt(consolidated, id.var = "Month"), aes(Month, value, fill = variable)) +
   geom_bar(stat = "identity") +
   labs(title = "Portfolio vs Benchmarks")
```

Risk Adjusted Performance

Portfolio vs Benchmarks
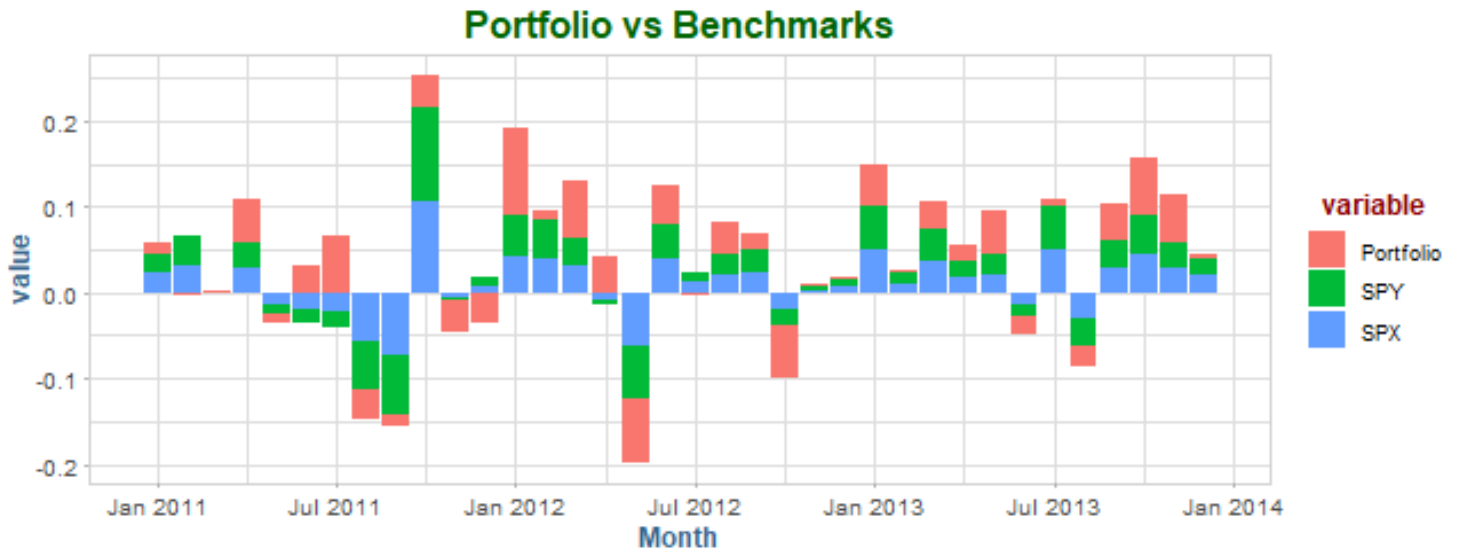
Sharpe Ratio

```
Rf <- 0.0007

sharpe_ratio <- function(returns, periods = 12, rf = 0.0003) ((mean(returns) * periods) - rf) /

sharpe_ratios <- list(Portfolio = sharpe_ratio(consolidated$Portfolio),
                      SPY = sharpe_ratio(consolidated$SPX))
```

Roy's Safty First Ratio

```
mar <- 0.015

roys_sf_ratio <- function(returns, periods = 12, mar = 0.0015) ((mean(returns) * periods) - mar

roysf_ratios <- list( Portfolio = roys_sf_ratio(consolidated$Portfolio),
                      Benchmark = roys_sf_ratio(consolidated$SPX))
roysf_ratios
```

```
$Portfolio
[1] 1.330641

$Benchmark
[1] 1.09904
```

Treynor Ratio

```r
reg <- lm(Portfolio ~ SPX, data = consolidated)

portfolio.beta <- coef(reg)[2]

treynor.ratio <- function(port, bench, periods = 12, rf = 0.0007) {
   reg <- lm(port ~ bench)
   beta <- coef(reg)[2]

   (mean(port) * 12 - rf) / beta
}

port.treynor <- treynor.ratio(consolidated$Portfolio, consolidated$SPX)
bench.treynor <- treynor.ratio(consolidated$SPY, consolidated$SPX)

treynor_ratios <- list(Portfolio = port.treynor, Benchmark = bench.treynor)
treynor_ratios
```

```
$Portfolio
    bench
0.2700107

$Benchmark
    bench
0.1549975
```

Sortino Ratio

```r
period.mar <- mar/12


dd.port <- sd(consolidated$Portfolio[which(consolidated$Portfolio < period.mar)]) * sqrt(12)
port.Sortino.ratio <- ((mean(consolidated$Portfolio) * 12) - Rf) / dd.port

dd.bench <- sd(consolidated$SPY[which(consolidated$SPY < period.mar)]) * sqrt(12)
bench.Sortino.ratio <- ((mean(consolidated$SPY) * 12) - Rf) / dd.port

sorinto_ratios <- list(Portfolio = port.Sortino.ratio, Benchmark = bench.Sortino.ratio)
sorinto_ratios
```

```
$Portfolio
[1] 2.187295
```

```
$Benchmark
[1] 1.871504
```

Information Ratio

```r
active.return <- with(consolidated, Portfolio - SPX)
alpha.port <- mean(active.return) * 12
tracking.error <- sd(active.return) * sqrt(12)

port.information.ratio <- alpha.port / tracking.error
port.information.ratio
```

```
[1] 0.4050027
```

```r
passive.return <- with(consolidated, SPY - SPX)
alpha.bench <- mean(passive.return) * 12
tracking.error <- sd(passive.return) * sqrt(12)

bench.information.ratio <- alpha.bench / tracking.error
bench.information.ratio
```

```
[1] 5.994108
```

```r
information_ratios <- list(Portfolio = port.information.ratio,
                           Benchmark = bench.information.ratio)
information_ratios
```

```
$Portfolio
[1] 0.4050027

$Benchmark
[1] 5.994108
```

Consolidated Risk Table

```r
risk.table <- data.table(Asset = c("Portfolio", "Benchmark"),
                         Sharpe = sharpe_ratios,
                         `Roy SF` = roysf_ratios,
                         Treynor = treynor_ratios,
                         Sorinto = sorinto_ratios,
                         Information = information_ratios)

formatted <- melt(risk.table, id.var = "Asset", variable.name = "Metric", value.name = "Value")

formatted
```

```
        Asset      Metric     Value
 1: Portfolio      Sharpe  1.339509
 2: Benchmark      Sharpe  1.108932
 3: Portfolio      Roy SF  1.330641
 4: Benchmark      Roy SF   1.09904
 5: Portfolio     Treynor 0.2700107
 6: Benchmark     Treynor 0.1549975
 7: Portfolio     Sorinto  2.187295
 8: Benchmark     Sorinto  1.871504
 9: Portfolio Information 0.4050027
10: Benchmark Information  5.994108
```

```r
ggplot(formatted, aes(Metric, Value, fill = Asset)) +
   geom_bar(stat = "identity", position = "stack")
```

```
Warning in data.frame(structure(list(x = c(1L, 1L, 2L, 2L, 3L, 3L, 4L, 4L, : row
names were found from a short variable and have been discarded
```