STAT 686

DOGS OF THE DOW

Mini-Project 1
February 24th, 2011

Group 3
Dallam Masterson
Sarah Tooth
Justin Silver

INTRODUCTION

The *Dogs of the Dow*, a simple portfolio construction strategy, finds great favour with some investors who believe it allows them to consistently outperform benchmarks with a minimum of trading costs. Too, they content that this strategy reduces their risk, defined here as the standard deviation of their annual returns. In this project, we seek to assess these claims by reviewing the performance of this strategy over a period of fifty years.

A Dogs of the Dow Portfolio consists of the ten stocks with the highest dividend yield from the previous year, out of the thirty listed on the Dow Jones Industrial Average. It is rebalanced annually, so as to reduce both trading costs and taxation, which are both important considerations in true portfolio management, even if not in academic portfolio design.

CONSIDERATIONS IN PORTFOLIO CONSTRUCTION

In our analysis the insertion and deletion of the 30 Dow stocks each year was assumed to occur in the beginning of the year. A more accurate approach would be to remove these companies at their exact delisted date, and if we were invested in a bad company we would immediately sell that stock and buy the newcomer. Although we would realize a higher loss in this way it would be a more accurate portrayal of the real world.

By removing the bad stocks prematurely we introduce a forward bias if we are using a random 10 stock selection method with yearly rebalancing. On the other hand, the premature removal method would not affect the Dogs of the Dow approach since none of the deleted stocks were part of the top ten dividend yielding companies. In our Mini project we focused on the Dogs of the Dow strategy to see if we can reconcile our results with the published Dogs of the Dow results made available by many sources. If we were to consider a random 10 portfolio selection scheme, we would have to eliminate this forward bias and add the necessary complexity to our model.

OTHER CONSIDERATIONS

Although taxation and trading costs are an important consideration in true portfolio management, they are not taken into account in this project, in part because of the extremely variable nature of these factors. Taxation laws can change at the whim of a government, and it is unreasonable to expect them to stay consistent through the fifty years under consideration in this project. Too, the taxation of a portfolio will be dependent on how an individual structures their accounts – if, for instance, this strategy is enacted in a tax-deferred or tax-free account.

Trading fees, too, have changed dramatically over the years, beginning with the introduction of electronic trading in the 1970s. Changes in fee structures remain variable between brokerages, and may depend on such factors as the size of the account and the frequency of trading.

Various performance benchmarks can be considered. For our purposes, the performance of the Dow Jones Industrial Average as a whole, including dividends, was chosen. Cited DJIA returns do not typically include dividends; however, because dividends are a primary consideration in the design of the Dogs portfolio, it was felt that it was important to include these in both performance and benchmark calculations. Taken without dividends, the DJIA typically underperforms other popular benchmarks including the NYSE, NASDAQ, and S&P500 (equal or value weighted, with or without dividends).[1] The DJIA, even with dividends included, is therefore felt to be a conservative benchmark by which to gauge performance.

[1] Masterson, Tooth, Yang & Silver. "Benchmarks." February 3rd, 2011.

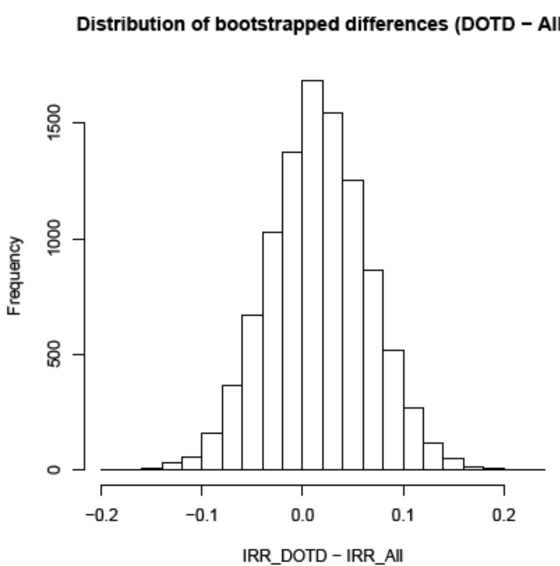
SUMMARY OF RETURNS (1960 – 2010)

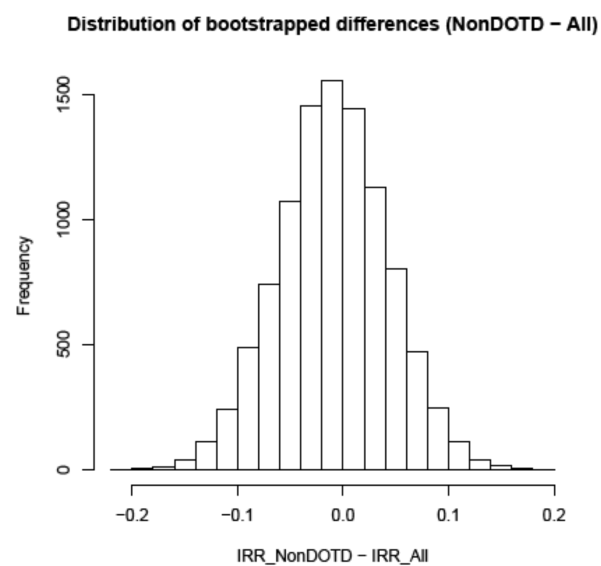
Portfolio	Min	Q1	Med	Mean	Q3	Max	Std. Dev.	N-year IRR
Dogs	-0.4245	0.0398	0.1698	0.1927	0.2855	0.8381	0.2476	0.1944
Non-Dogs	-0.5026	-0.0390	0.1521	0.1731	0.2974	0.8068	0.2737	0.1389
All DOW	-0.4789	-0.0065	0.1705	0.1801	0.2963	0.7500	0.2588	0.1132

The Dogs of the Dow portfolio has a higher mean annual return (19.27%) than both the portfolio consisting of non-Dogs Dow stocks (17.31%) and that consisting of all Dow stocks (18.01%), and it also has a considerably higher N-year internal rate of return (19.44%) than the other two portfolios. We will examine whether this difference is statistically significant by bootstrapping the differences in the N-year IRRs for the "Dogs" and "All Dow" portfolios as well as for the "non-Dogs" and "All Dow" portfolios.

BOOTSTRAPPED DIFFERENCES IN N-YEAR IRRS

Difference from DJIA	Min	Q1	Med	Mean	Q3	Max	Std. Dev.	Bootstrap 95% CI
Dogs	-0.1930	-0.0170	0.0158	0.0159	0.0484	0.2254	0.0494	(-0.0800, 0.1126)
Non-Dogs	-0.2127	-0.0434	-0.0095	-0.0095	0.0256	0.1968	0.0519	(-0.1124, 0.0910)





The difference between the N-year IRRs of the Dogs of the Dow portfolio and that of the portfolio consisting of all Dow stocks has a mean of 1.58%, while the difference between the N-year IRRs of the non-Dogs of the Dow portfolio and that of the portfolio consisting of all Dow stocks is -0.95%. Nonetheless, both bootstrapped differences have 95% confidence intervals that contain 0. Thus, at a 5% level of significance, we fail to reject the null hypothesis that there is no difference between the N-year IRR of the Dogs of the Dow portfolio and that of all Dow stocks – likewise for the difference between the N-year IRR of the non-Dogs of the Dow portfolio and that of all Dow stocks.

Conclusions

While the Dogs of the Dow does have a higher average annual return than either the DJIA or the non-Dog stocks of the DJIA, it does not appear to be significantly different at the 95% confidence level. Therefore, while past results might indicate that the Dogs of the Dow is a winning strategy, there is no evidence to suggest that it will continue to be so, nor that this past success is in any way indicative of the soundness of the strategy in beating the benchmark.

APPENDIX: CODE

```
# ==========================================================================
# Return Calculations
# ==========================================================================

library(ggplot2)

a <- read.csv("dow19601976.csv")[, 1:6]
b <- read.csv("dow19771979.csv")[, 1:6]
c <- read.csv("dow19801982.csv")[, 1:6]
d <- read.csv("dow19831985.csv")[, 1:6]
e <- read.csv("dow19861987.csv")[, 1:6]
f <- read.csv("dow19881991.csv")[, 1:6]
g <- read.csv("dow19921997.csv")[, 1:6]
h <- read.csv("dow19981999.csv")[, 1:6]
i <- read.csv("dow20002003.csv")[, 1:6]
j <- read.csv("dow20042004.csv")[, 1:6]
k <- read.csv("dow20052005.csv")[, 1:6]
l <- read.csv("dow20062008.csv")[, 1:6]
m <- read.csv("dow20092009.csv")[, 1:6]
n <- read.csv("dow20102010.csv")[, 1:6]

dow <- rbind(a, b, c, d, e, f, g, h, i, j, k, l, m, n)
dow <- transform(dow, year = trunc(DATE/10000),
  gret = RET + 1, gretx = RETX + 1)

dowy <- ddply(dow, c("TICKER", "year"), summarize,
 ret = prod(gret), retx = prod(gretx))
dowy <- transform(dowy, div = ret - retx)

for (i in nrow(dowy) : 2) {
  if (dowy$TICKER[i] == dowy$TICKER[i-1]) {
    dowy$div[i] <- dowy$div[i-1]
  } else {
    dowy$div[i] <- 0
  }
}
dowy$div[1] <- 0
dowy <- arrange(dowy, year, desc(div))

dowy$rank <- 1
for (i in 2:nrow(dowy)) {
  if (dowy$year[i] == dowy$year[i-1]) {
    dowy$rank[i] <- dowy$rank[i - 1] + 1
  } else {
    dowy$rank[i] <- 1
  }
}
# Have as many as 36 stocks in a year

dowy$ret <- dowy$ret - 1

dod <- subset(dowy, rank < 11)
pod <- subset(dowy, rank > 10)

write.table(dod, file = "dogs.txt", append = F, sep = "\t")
write.table(pod, file = "not_dogs.txt", append = F, sep = "\t")
write.table(dowy, file = "all.txt", append = F, sep = "\t")
```

```
all_rtn <- ddply(dowy, "year", summarise, rtn = mean(ret), sd = sd(ret))
dod_rtn <- ddply(dod, "year", summarise, rtn = mean(ret), sd = sd(ret))
pod_rtn <- ddply(pod, "year", summarise, rtn = mean(ret), sd = sd(ret))

all_rtn$set <- "all"
pod_rtn$set <- "ndog"
dod_rtn$set <- "dod"

rtns <- rbind(all_rtn, dod_rtn, pod_rtn)

write.table(rtns, file = "returns.txt", append = F, sep = "\t")

# ===========================================================================
# Statistical Analysis
# ===========================================================================

x <- read.table("returns.txt")
x$rtn <- x$rtn + 1  # Prepare returns for geometric mean calc

# Summarize returns for DOTD, non-DOTD, all DOW

d <- x[x$set == "dod", ]
summary(d$rtn-1)
sd(d$rtn-1)
a <- x[x$set == "all", ]
summary(a$rtn-1)
sd(a$rtn-1)
n <- x[x$set == "ndog", ]
summary(n$rtn-1)
sd(n$rtn-1)

# 52-year IRRs

irr_d <- (prod(d$rtn))^(1/52)
irr_d
irr_n <- (prod(n$rtn))^(1/52)
irr_n
irr_a <- (prod(a$rtn))^(1/52)
irr_a

# dogs - all

diff_da <- rep(NA, 10000)

for(i in 1:10000) {
  d_samp <- sample(d$rtn, 52, replace = T)
  a_samp <- sample(a$rtn, 52, replace = T)
  irr_d <- (prod(d_samp))^(1/52)
  irr_a <- (prod(a_samp))^(1/52)
  diff_da[i] <- irr_d - irr_a
}

x11()
hist(diff_da, main = "Distribution of bootstrapped differences (DOTD - All)",
  xlab = "IRR_DOTD - IRR_All")
summary(diff_da)
sd(diff_da)
c(sort(diff_da)[250],sort(diff_da)[9750]) # 95% bootstrap CI
```

```
# ndogs - all

diff_na <- rep(NA, 10000)

for(i in 1:10000) {
  n_samp <- sample(n$rtn, 52, replace = T)
  a_samp <- sample(a$rtn, 52, replace = T)
  irr_n <- (prod(n_samp))^(1/52)
  irr_a <- (prod(a_samp))^(1/52)
  diff_na[i] <- irr_n - irr_a
}

x11()
hist(diff_na, main = "Distribution of bootstrapped differences (NonDOTD - All)",
  xlab = "IRR_NonDOTD - IRR_All")
summary(diff_na)
sd(diff_na)
c(sort(diff_na)[250],sort(diff_na)[9750]) # 95% bootstrap CI
```