Rebalancing Weights to AUM to Invest

June 20, 2021

This is penned after rebalancing the `bt77` portfolio in 2021-Jun.

Here, the author illustrates a particular `bt77` Portfolio-optimization rebalancing selected from an earlier research viewpoint 500 Invest for 36% CAGR: to move it from its latest-rebalancing weights to the (Assets Under Management) AUM monies required to invest using it where fractional shares are unsupported. This demonstrates feasibility of really investing with it, of course, without any advice or Suitability recommendation to do so for anyone referring to this. Looks like INR 2.5 lakhs (Rs 250,000) suffices to invest on the latest Portfolio rebalancing. And we saw in the previous viewpoint that this `bt77` is one of those whose performance exceeded the return target of 36% CAGR. We also saw there that its Information Ratio exceeded 1 during the period of study when using as benchmark an Equal-Weighted Portfolio rebalancing quarterly across the 350+ stocks being used (an asset universe taken from the `BSE500` market-capitalization-based index).

Considering that `bt77` has been developed using Free Open Source Software and is published reproducibly, the author asserts that it can serve as a benchmark index for (pension) fund management.

- Individual or other investors could use it to negotiate extraordinary performance and incentive structures with their providers of wealth-management services and products. They could also build on it in collaborative or Do-It-Yourself mode.
- For greater societal impact, PFRDA could similarly nudge Pension Fund Managers for Minimum Assured Returns in DC Pension Systems. The author is not a qualified Actuarial professional, but browsing through related published content on `www` , there seems to be an underlying belief that the Equity asset category presently permitted within National Pension System (NPS) is limited to the "market return" provided by `NIFTY50` market-capitalization-based index. Continuing that way, the fund has to continue tolerating Drawdowns ("downsides") of 30% to 50% while the upside is unlikely to be over 15% CAGR long term, with 5-10 years of sideways markets every now and then. Almost certainly then, growth would continue to be ordinary while tolerating high Drawdown (or Expected Tail Loss) risk. Instead, what PFRDA and India's Ministry of Finance could consider (if not already done so) is extraordinary growth (at possibly-lesser risk as exemplified via `bt77` investible benchmark). Creating that alternative future is consistent with Suitable and sustainable pensions. India's Minister of Finance invited inputs for the upcoming "Budget like never before" ("in a way. 100 years of India wouldn't have seen a Budget being made post-pandemic like this"). As an input, may this proposal find its way forward to transform the wealth ecosystem. Through Clawbacks or other loss-sharing provisions, incentive structures can be harmonized:
    - Harmony can be in quantum and timing with real positive growth in wealth, e.g., as measured by Net Present Value adjusted by Time Value of Money and Risk Premium.
    - And creating an exemplar fund-management enterprise as a Social Business could (a) deny the incentive of perpetual dividend to owners of Pension-Fund Manager institutions and (b) devote the enterprise's profits and actions solely and maximally for its societal purpose of serving adequate pensions forever. That enterprise could "own" and maintain `bt77` and other outputs of this Project Portfolios for Pension Funds, as part of causing Peer production (and aggregation) of wealth-management-related cultural and information objects in the Commons. On the advantages of Commons-based Peer production, you can refer http://www.benkler.org/CoasesPenguin.html which says:

> I suggest that we are seeing is the broad and deep emergence of a new, third mode of production in the digitally networked environment. I call this mode "commons-based peer-production," to distinguish it from the property- and contract-based models of firms and markets. Its central characteristic is that groups of individuals successfully collaborate on large-scale projects following a diverse cluster of motivational drives and social signals, rather than either market prices or managerial commands. ... The paper also explains why this mode has systematic advantages over markets and managerial hierarchies when the object of production is information or culture, and where the capital investment necessary for production-computers and communications capabilities-is widely distributed instead of concentrated.

Portfolio Rebalancing Performance and Weights

```
## Warning: Ensure correct files list in flist via DOS cmd: > dir /b /o-d bt* >
## flist.txt

## [1] "Presumed parts of gettingStarted.R have a Portfolio optimization rebalancing (eg bt77) before entering this c
```

```
## [1] "Sun Jun 20 15:26:18 2021"

## [1] 1

## [1] "bt-rebal13opt_pfESplus-ESarg3Retarg3ES1-202106201515-202106201516.rds"

##        CGCL      ECLERX   ORIENTELEC     KPRMILL      SOLARA    JSWENERGY
## 0.222996494 0.107281043 0.078099070 0.078068255 0.077353940 0.073816395
##      POLYCAB   CENTURYPLY    BAJAJCON        ATGL         IEX        GICRE
## 0.071651417 0.054724541 0.053588143 0.041788097 0.037947358 0.036357797
##      POLYMED      CRISIL        ISEC        KSCL  HINDCOPPER
## 0.023015568 0.019183461 0.012169324 0.007481099 0.004477999

## Warning in mycharts.PerformanceSummary(btouts.rets[[ix]], main =
## paste0("Rebalancing performance")): Rf=0, geometric=TRUE, ylog=FALSE.
```
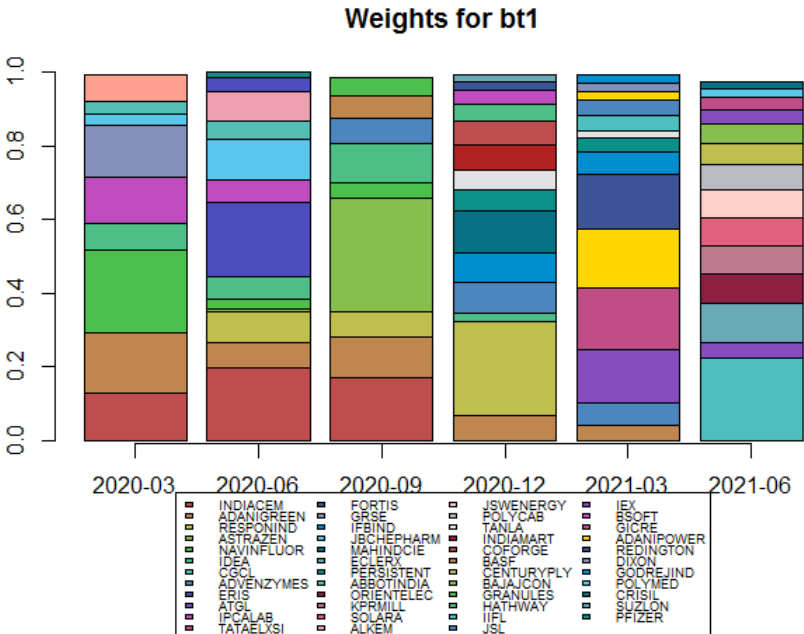

Rebalancing performance

```
## NULL
```


Weights for bt1
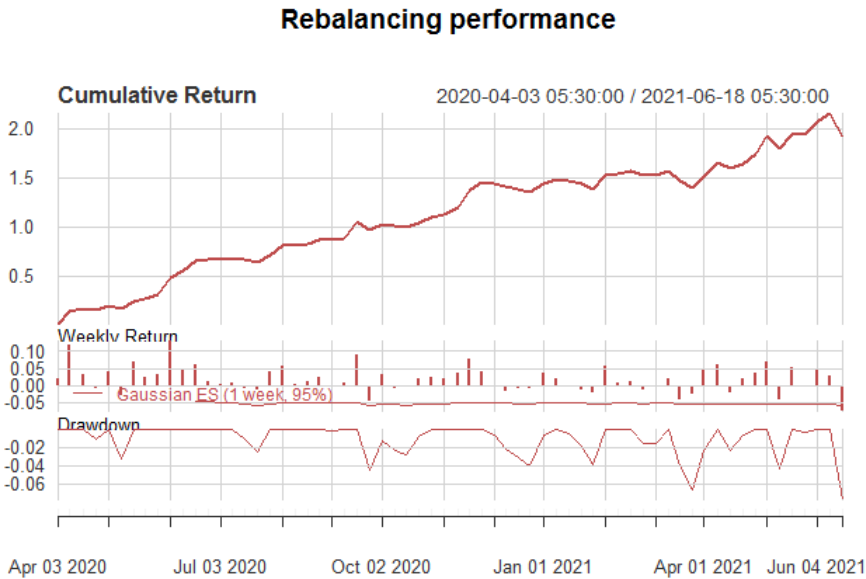
Translating Portfolio Weights to Share Counts

```
## [1] "This would require the stock-wise wealth or AUM invested to be:"
##                          CGCL    ECLERX ORIENTELEC  KPRMILL    SOLARA JSWENERGY
## 2021-06-18 05:30:00 29828.25 14350.03   10446.61 10442.49 10346.94  9873.759
##                         POLYCAB CENTURYPLY BAJAJCON    ATGL      IEX    GICRE
## 2021-06-18 05:30:00 9584.169   7320.012 7168.007 5589.62 5075.879 4863.257
##                         POLYMED CRISIL      ISEC     KSCL HINDCOPPER
## 2021-06-18 05:30:00 3078.587    2566 1627.782 1000.68    598.9818
## [1] "So, total AUM= 133761"
## [1] "Let's pray this works, and you don't face liquidity issues."
## [1] "Beware that market prices at Buy could still differ from these prices estimated with:"
##                          CGCL ECLERX ORIENTELEC KPRMILL  SOLARA JSWENERGY POLYCAB
## 2021-06-18 05:30:00 530.75 1766.4     320.65 1530.25 1727.55    157.75  1936.3
##                        CENTURYPLY BAJAJCON    ATGL    IEX  GICRE POLYMED CRISIL
## 2021-06-18 05:30:00       414.05    297.5 1258.45 378.4 201.75  902.65    2566
##                           ISEC    KSCL HINDCOPPER
## 2021-06-18 05:30:00 639.3 729.35      143.9

## [1] "For share counts from last-rebalancing weights, use a multiple of the following counts:"

##                          CGCL ECLERX ORIENTELEC KPRMILL SOLARA JSWENERGY POLYCAB
## 2021-06-18 05:30:00 56.2    8.1       32.6     6.8      6      62.6     4.9
##                        CENTURYPLY BAJAJCON ATGL  IEX GICRE POLYMED CRISIL ISEC
## 2021-06-18 05:30:00          17.7     24.1  4.4 13.4  24.1     3.4      1  2.5
##                           KSCL HINDCOPPER
## 2021-06-18 05:30:00  1.4        4.2

## [1] "Browse further for any deeper understanding you might wish."
```

(Contribution to) Expected Tail Loss of Portfolio

```
## [1] "opt_pfESplus-ESarg3Retarg3ES1-202106201515.rds"
```

```
tmp.ES <- ES(RtrgWin,
  # knitr() throws error: number of items in weights not equal to number of columns in R Calls.
  p=cESpValue, clean="none", method="gaussian", portfolio_method="component",
  weights=pfLastWts,
  sigma=lw.sigma(RtrgWin)$sigma # via momentFUN=
); str(tmp.ES) # ES : num -0.00248 !!
```

```
## List of 3
##  $ ES            : num 0.0245
##  $ contribution  : Named num [1:471] 0 0 0 0 0 0 0 0 0 0 ...
##   ..- attr(*, "names")= chr [1:471] "SBIN" "JSWSTEEL" "TCS" "M.M" ...
##  $ pct_contrib_ES: Named num [1:471] 0 0 0 0 0 0 0 0 0 0 ...
##   ..- attr(*, "names")= chr [1:471] "SBIN" "JSWSTEEL" "TCS" "M.M" ...
```

```
tmp.ES.contribNot0 <- (tmp.ES$contribution[tmp.ES$contribution != 0])[names(pfLastWts.sortGt0)]; str(tmp.ES.contribNo
```

```
##  Named num [1:17] 0.00647 0.00353 0.00129 0.00121 0.00268 ...
##  - attr(*, "names")= chr [1:17] "CGCL" "ECLERX" "ORIENTELEC" "KPRMILL" ...
```

```
tmp.ES.pct_contribNot0 <- (tmp.ES$pct_contrib_ES[tmp.ES$pct_contrib_ES != 0])[names(pfLastWts.sortGt0)]
str(tmp.ES.pct_contribNot0)
```

```
##  Named num [1:17] 0.2641 0.1441 0.0527 0.0492 0.1094 ...
##  - attr(*, "names")= chr [1:17] "CGCL" "ECLERX" "ORIENTELEC" "KPRMILL" ...
```

```
plot(tmp.ES.contribNot0); text(tmp.ES.contribNot0, names(tmp.ES.contribNot0), cex=0.8/1.0,
  col="blue")
```
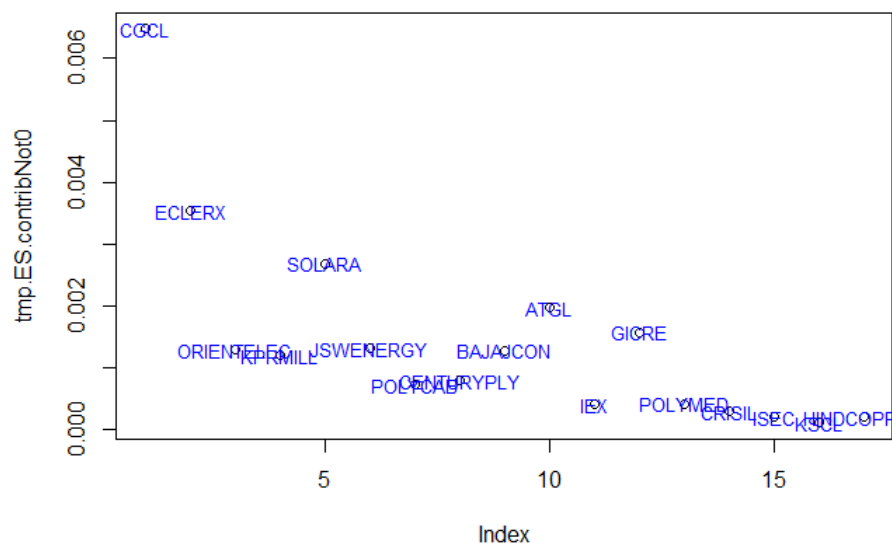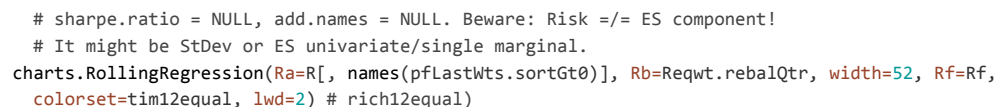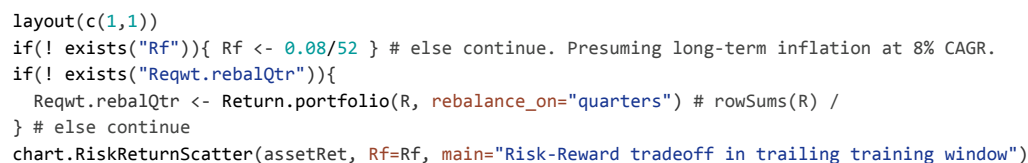
```
plot(tmp.ES.pct_contribNot0); text(tmp.ES.pct_contribNot0, names(tmp.ES.contribNot0),
  cex=0.8/1.0, col="blue")
```
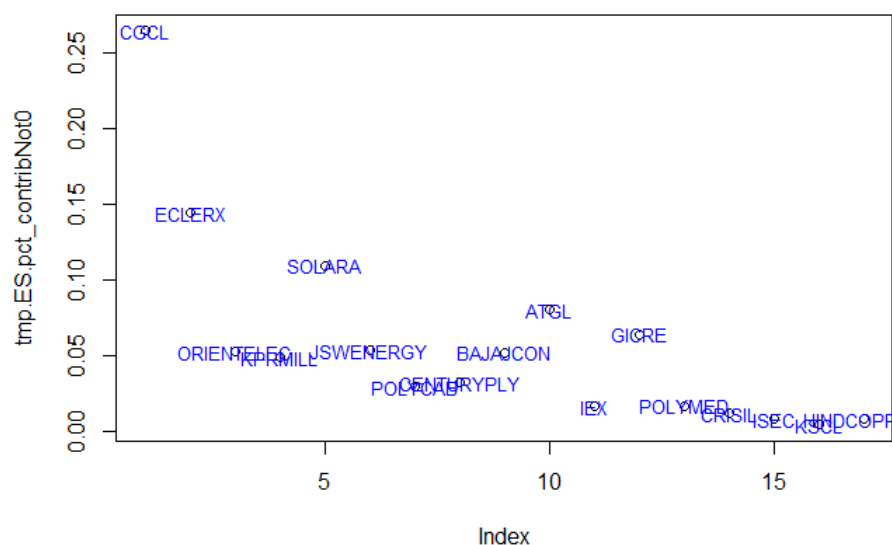

Normality of Returns and Other Investigations

```
# ref https://cran.csiro.au/web/packages/PerformanceAnalytics/vignettes/PA-charts.pdf:
assetRet <- RtrgWin[, names(pfLastWts.sortGt0)] # R[, "GRANULES"] # R
layout(rbind(c(1,2),c(3,4)))
chart.Histogram(assetRet, main = "Plain",
  sub=paste(head(colnames(assetRet)), collapse=","),
  methods = NULL)
# title(paste(head(colnames(assetRet)), collapse=","), cex.main=0.8)
chart.Histogram(assetRet, main = "Density", breaks=40, methods = c("add.density", "add.normal"))
chart.Histogram(assetRet, main = "Skew and Kurt", methods = c("add.centered", "add.rug"))
chart.Histogram(assetRet, main = "Risk Measures", methods = c("add.risk"))
```

Plain

Density

GCL,ECLERX,ORIENTELEC,KPRMILL,SOLARA,JSWENI

Skew and Kurt

Risk Measures

```
layout(c(1,1))
if(! exists("Rf")){ Rf <- 0.08/52 } # else continue. Presuming long-term inflation at 8% CAGR.
if(! exists("Reqwt.rebalQtr")){
  Reqwt.rebalQtr <- Return.portfolio(R, rebalance_on="quarters") # rowSums(R) /
} # else continue
chart.RiskReturnScatter(assetRet, Rf=Rf, main="Risk-Reward tradeoff in trailing training window")
```

Risk-Reward tradeoff in trailing training window


```
  # sharpe.ratio = NULL, add.names = NULL. Beware: Risk =/= ES component!
  # It might be StDev or ES univariate/single marginal.
charts.RollingRegression(Ra=R[, names(pfLastWts.sortGt0)], Rb=Reqwt.rebalQtr, width=52, Rf=Rf,
  colorset=tim12equal, lwd=2) # rich12equal)
```

Rolling 52-week Regressions
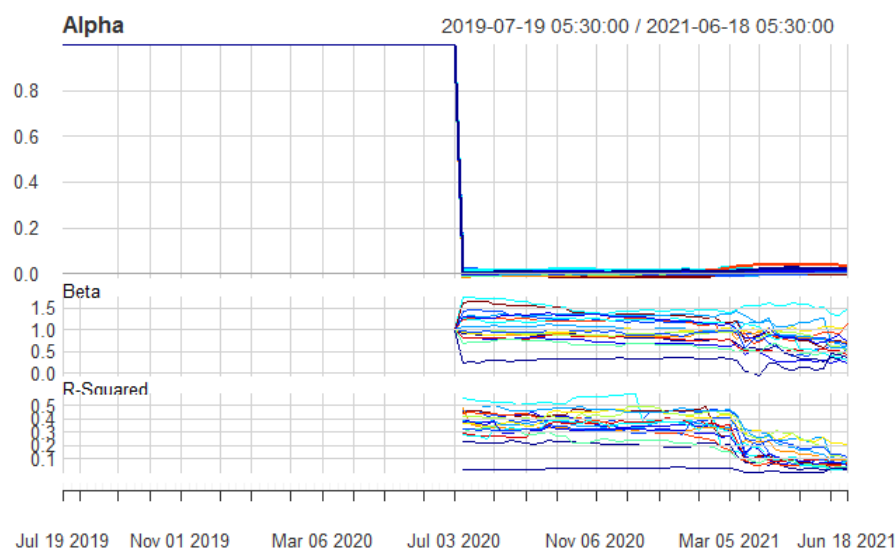
Appendix: Runtime Environment

Here's the runtime environment used. It's reported here for reproducibility:

```
sessionInfo() # Sys.info()[['sysname']]
```

```
## R version 3.6.2 (2019-12-12)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 8.1 x64 (build 9600)
##
## Matrix products: default
##
## locale:
## [1] LC_COLLATE=English_India.1252  LC_CTYPE=English_India.1252
## [3] LC_MONETARY=English_India.1252 LC_NUMERIC=C
## [5] LC_TIME=English_India.1252
##
## attached base packages:
## [1] parallel  stats     graphics  grDevices utils     datasets  methods
## [8] base
##
## other attached packages:
##  [1] unikn_0.3.0               PortfolioAnalytics_1.1.0
##  [3] PerformanceAnalytics_2.0.4 foreach_1.4.8
##  [5] xts_0.12.1                zoo_1.8-7
##  [7] ROI.plugin.quadprog_1.0-0  ROI.plugin.glpk_1.0-0
##  [9] ROI_1.0-0                 DEoptim_2.2-5
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_1.0.3        pillar_1.4.3       compiler_3.6.2
##  [4] iterators_1.0.12  tools_3.6.2        digest_0.6.24
##  [7] tibble_2.1.3      evaluate_0.14      lifecycle_0.1.0
## [10] gtable_0.3.0      lattice_0.20-38    pkgconfig_2.0.3
## [13] rlang_0.4.4       registry_0.5-1     Rglpk_0.6-4
## [16] yaml_2.2.1        xfun_0.19          dplyr_0.8.3
## [19] stringr_1.4.0     knitr_1.27         tidyselect_0.2.5
## [22] grid_3.6.2        glue_1.3.1         R6_2.4.1
## [25] rmarkdown_2.1     purrr_0.3.3        ggplot2_3.3.2
## [28] magrittr_1.5      scales_1.1.0       codetools_0.2-16
## [31] htmltools_0.4.0   assertthat_0.2.1   colorspace_1.4-1
## [34] numDeriv_2016.8-1.1 quadprog_1.5-8   stringi_1.4.6
## [37] munsell_0.5.0     slam_0.1-47        crayon_1.3.4
```