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SOCIETY OF ACTUARIES Technology Section

CompAct

ELECTRONIC NEWSLETTER

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R CORNER - CREATING HISTORICAL PORTFOLIOS

by Steve Craighead

Over the years, I have built a large number of econometric models, but the most painful part of the modeling process was to collect separate economic series and merge them together by date. I suffered the same fate when I created asset portfolios. Too much of my life was wasted in entering "N/A" on the assets at different dates in the consolidated portfolio.

The "tseries"[1] package in R has two very powerful commands. These are "get.hist.quote" and "merge." The first one allows you to download assets from both quote.yahoo.com and oanda.com, using asset ticker symbols. Also, the starting date and the ending date for the date extraction must be specified. The quotes pulled can be specified as "Open," "High," "Low," "Close," "AdjClose," and "Volume." Extraction of data on a daily, weekly or monthly basis is allowed. The only draw back is that "get.hist.quote" only extracts one set of quotes at a time. To overcome this weakness, the "merge" command comes to the rescue. Say that you have a portfolio of one asset (call this "Portf") and you use "get.hist.quote" to obtain another asset (call this "asset"). By using the command "Portf-merge(Portf,asset)," the resultant portfolio Portf has merged the two assets. All dates are consistent and any missing data automatically has the "N/A" inserted. By setting up a loop over a list of ticker symbols combined with "get.hist.quote" and "merge," all the asset data are consolidated and the N/As are in the right place!

To aid you in this, I have constructed a function that takes a ticker list, a start and a finish date and a numerical code (1, 2, or 3) to

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specify the extraction as daily, weekly or monthly. It is limited in that it pulls from quote.yahoo.com and only closing quotes are returned. This function is called "buildportfolio" and is available at portfolio. The function is well documented with the first portion of the function implementing a loop through the ticker symbols, extracting and merging the closing prices into a portfolio. The results of this are returned as "PricePortfolio." The second half of the function will remove all N/As and create the price returns {(PRICE2-PRICE1)/PRICE1} through time. The return data is called PRPortfolio.

For example, define the ticker to pull the DJIA, S&P500, FTSE, DAX, Nikkei 225 and the Hang Seng indices with this command:

```
(ticker<-c("^DJI","^GSPC","^FTSE","^GDAXI","^N225","^HSI"))
```

Note that the ticker symbols correspond to the ones used in finance.yahoo.com.

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[1]Adrian Trapletti and Kurt Hornik (2009). tseries: Time Series Analysis and Computational Finance. R package version 0.10-22.

To set the time horizon for the data extraction use the "YYYY-MM-DD" format for the dates:

```
(startdate <- "1990-12-03")
(enddate <- "2010-08-02")
```

Use 1 for daily rates, 2 for weekly rates and 3 for monthly rates. Set the extraction frequency as daily:

```
(freq<-1)
```

Now store the results in the test object by this command:

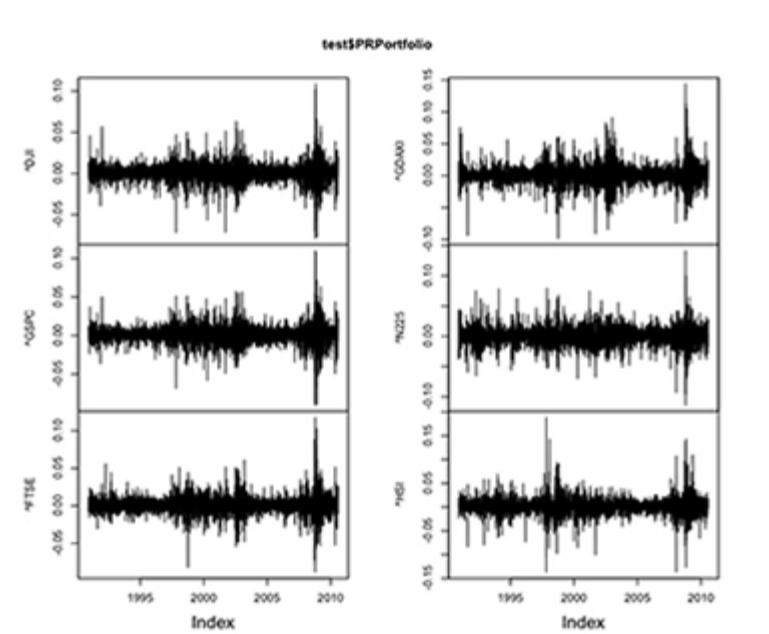
```
test<-buildportfolio(ticker,startdate,enddate,freq)
```

You access the closing index values by referring to test$PricePortfolio. The price returns are in test$PRPortfolio.

To plot each of the closing values through time use this command:

```
plot(test$PricePortfolio)
```

Figure 2: Price Returns



Enlarge

Over the next several articles, I will examine two separate applications that can use the "buildportfolio" function. The first application is the generation of extreme scenarios by implementing Dependent Multidimensional Fractional Brownian Motion (DMFBM). These extreme scenarios correspond to what Taleb calls "Mandelbrotian Grey Swans." When prices are modeled with DMFBM the various asset prices are dependent upon one another, produce long memory models and have heavier tails than lognormal. These traits correspond to Mandelbrot's[2] and Taleb's view of fractal and power scaling traits observed in market prices.

The final application will be using packages that have implemented portfolio theory. Our goal in that article is to look at various types of efficient frontiers.

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[2]Benoit Mandelbrot (1997), "Fractals and Scaling in Finance, Discontinuity, Concentration, Risk," Springer-Verlag, New York, NY.

[3]Nassim Taleb (2010), "The Black Swan, the Impact of the Highly Improbable, 2nd Edition," Random House Trade Paperbacks, New York, NY.

So hold on to your hats, the next article will really go to the extremes!

Actuaries
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