WMPR R Programming Assessment
Date: 2/1/2023

This assessment should be done using the R programming language. It can be completed in either a Jupyter notebook (with R kernel), R Markdown file or with a plain R script with any questions answered separately in a Word document. The script should be able to run as a standalone on someone else's computer, assuming they have the same data available to them in their working directory as outlined below. It's OK to you use any external libraries except where noted in the assessment and can assume the other person's computer has these libraries installed.

Data

For this assessment you will be working with three different data sources. The first two are as follows and can be accessed from their Dropbox links:

1. *Fund Data* – Monthly return data for three hypothetical mutual funds. (https://www.dropbox.com/scl/fi/i84z3g58ccgf1dg9cmd0m/Funds.xlsx?dl=0&rlkey=yzgks0t96n6cnxu6amau6p1qo)
2. *Benchmark Data* – Monthly return data for a benchmark that we will assume is the benchmark for the three mutual funds. (https://www.dropbox.com/scl/fi/9i1vutbd5908vw1g8qfjm/Bmark.xlsx?dl=0&rlkey=mcj64ud1cak14rbkjdwtc8fiv)

The third piece of data will be some factor return data that will be sourced from the web. The data will come from the Ken French data library at this address: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

We want to use the monthly data the Fama/French Developed 3 Factors dataset located about 2/3rds of the way down the page here:

The script should either directly read in this data or download it to the working directory and read in from there. In other words, there should be no need to manually click and download the data from the Ken French website.

Vs. Benchmark Analysis

We want to look at three metrics of relative performance and risk versus the given benchmark for the three funds:

- The first is the annualized ex-post tracking error versus the benchmark.
- The second is the annualized information ratio relative to the benchmark.
- The third is the beta relative to the benchmark.

Each of these equations can be Googled if need be. The script should not use any external libraries to calculate each metric and instead use base R functions wrapped in a custom function for each of these. Please calculate the three metrics for each fund's own individual common return history with the benchmark. Create a data frame with the Fund Name, Tracking Error, Info Ratio and Beta as columns. Any comments on the metrics for each fund?

Vs. Factor Model

We will be using the Fama-French Developed 3-Factor model as the factor model to compare each of these returns against. Run a basic linear regression for each fund versus this 3-factor model and be sure to account for the risk-free rate (included with the French data) on the left-hand side of the regression. Create a data frame with the following columns: Fund Name, Alpha (annualized), Alpha t-Stat, Developed Market Beta, Developed Market t-Stat, Developed Size Beta, Developed Size t-Stat, Developed Value Beta, Developed Value t-Stat, Adj. R2. Any comments on any of the regression results?

Submitting

Northern's email server will likely filter out a notebook or script attachment so you could either upload to your Github and send me the link(s) or send directly to my personal email at: sgermani12@gmail.com