The goal of this exercise is for us to understand your ability to perform statistical analysis that is relevant in finance and economics. We are aware that you may not have training in economics and finance but do your best to complete the exercise as described. If you are not able to complete parts, it will be helpful if you include a comment in your code explaining what you had trouble with and what you tried. Cite any resources you use and please do not discuss this with anyone else.

Please complete this exercise in whatever programming language you prefer. You should return a zip file to us by e-mail that includes: a commented code file that produces your results, the clean data that your code imports to produce the results, and a small text document with your output. Be sure that we can open the zip file and run your code as is to reproduce your results. We will not answer any questions about the task.

The purpose of this task is to generate results similar to those in Moreira and Muir (2017):

https://www.dropbox.com/s/4y24nnab001bd0l/JF_PublishedVersion_Moreira_Muir_2017.pdf?dl=0

All of the data that you need is available on Ken French's data website:

http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

You will need to download "**Fama/French 5 Factors (2x3) [Daily]**" and "**Fama/French 5 Factors (2x3)**" (this is monthly data). These two datasets contain what are referred to in Moreira and Muir (2017) as "buy-and-hold portfolio excess returns" for the following factors: Mkt (Mkt-RF), SMB, HML, RMW, and CMA. Note that these data start in 1963, while the Moreira and Muir data start in 1926. You will likely need to clean this data to import it. In particular, the monthly data has yearly data at the end that you will want to remove. With this data, please produce the following:

1. Using the daily data, produce a figure similar to Figure 2. This figure is produced by calculating equation (2) for each factor. You only need to include Mkt, SMB, HML, RMW, and CMA. You do not need to include the NBER recession bars. Your figure should start in 1963 and end with the most recent date.
2. Using the monthly realized factor variances (equation 2), construct volatility managed factors for each of the 5 factors in your data as in equation (1). Use the daily data to calculate the monthly realized factor variances and that there are 22 days of returns in each month. You can simply calculate the variance of each factor's excess returns within each month. Then merge the monthly realized factor variances with the monthly factor excess returns to calculate equation (1). You will need to choose the value c as is specified in the paper. Using the volatility managed factors and the original factors, run

the regression specified in equation 3 for each of the factors. The returns are monthly values so to get numbers of similar magnitude as in Moreira and Muir (2017) you can scale them to annual by multiplying by 12. Your final output for this will be a table similar to table I panel A, but for only 5 factors: Mkt, SMB, HML, RMW, and CMA.