This will introduce you to the idea of time series tests of the CAPM. You should download the monthly returns of 10 equal-weighted portfolios formed on Dividend to price (D/P), and a proxy for the market risk premium (R_M - R_f), the HML portfolio (book-to-market factor), the SMB portfolio (size factor), and the monthly T-bill return (R_f) from 1964 until 2011 from the website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/. You may use any statistical package to do your work. Your report should include tables of results, not copies of computer output. All tables and charts should have legends and explanations. Answers (excluding tables and figures) should be typed and a maximum of four pages long (Times New Roman 11p font or larger, 1.5 line spacing, 1 inch margins).

a) (10 points)
Test whether the CAPM can price SMB and HML.

b) (30 points)
Estimate a time series regression of the form,

\[(R_{pt} - R_{ft}) = a + \beta_{pM} (R_{Mt} - R_{ft}) + e_{pt}\]

for each of the ten portfolios formed on D/P. Summarize the regression results in a table. Please include parameter estimates and t-stats (according to the format below). Perform the multivariate GRS test; please report both the Gibbons-Ross-Shanken (GRS) statistic and its p-value. (10 points each)

i) What is the null hypothesis of the GRS test (be precise), and how is this a test of the mean variance efficiency of our proxy for the market portfolio?

ii) How is the Sharpe ratio related to the GRS test statistic?

iii) Does the CAPM have difficulty pricing any portfolios in particular? Why?

c) (60 points)
Using all ten D/P portfolios, estimate the Fama-French three-factor model using time-series regressions.
i) (15 points) How does the estimation of the factor premia differ in the time-series regressions from the cross-sectional approach (used in problem set 1)?

ii) (30 points) Does the GRS test reject the three-factor model?

iii) (5 points) Does the three-factor model have difficulty pricing any portfolios in particular?

iv) (10 points) Comment on the observed patterns of factor loadings across portfolios, bearing in mind the characteristics on which the portfolios were formed.

For parts b and c, please report the statistics for the 10 portfolio in the following way (4 digits):

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