**Efficient Frontier**

Industry\_Portfolios.xlsx contains monthly nominal (net) returns (expressed as percentages) for ten industry portfolios, over the ten-year period from Jan 2004 through Dec 2013.

Use these returns to estimate the vector of mean returns and the covariance matrix of returns for the ten industry portfolios:

* Create a table showing the mean return and standard deviation of return for the ten industry portfolios.
* Plot the minimum-variance frontier (without the riskless asset) generated by the ten industry portfolios:
  + This graph must have expected (monthly) return on the vertical axis vs standard deviation of (monthly) return on the horizontal axis.
  + This graph must cover the range from 0% to 2% on the vertical axis, in increments of 0.1% (or less).
* Briefly explain the economic significance and relevance of the minimum-variance frontier to an investor.

Now suppose that the (net) risk-free rate is 0.13% per month:

* Plot the efficient frontier (with the riskless asset) on the same graph as the minimum-variance frontier generated by the ten industry portfolios.
* Briefly explain the economic significance and relevance of the efficient frontier to an investor.

The two frontiers will intersect at single point: the tangency portfolio:

* Calculate the Sharpe ratio for the tangency portfolio, and also the tangency portfolio weights for the ten industry portfolios.
* Briefly explain the economic significance and relevance of the tangency portfolio to an investor.

Please submit your results (including relevant tables and graphs) as an Adobe PDF file to [Homework 1](https://elearn.smu.edu.sg/d2l/common/dialogs/quickLink/quickLink.d2l?ou=396479&type=dropbox&rcode=smu-1288714).