

Some Suggestions for the Project

In what follows are some suggestions for your final project. You need to find your own data and a good source for it is yahooofinance.com. You will need to use at least 8 assets and you should look for at least 5 years of monthly closing prices. The risk free rates can be found at this link <http://www.federalreserve.gov/releases/h15/data.htm> under Treasury bills (secondary market) (3months, weekly, monthly or annually). Your write-up should be formal and no more than 5 pages. You can have in addition an appendix for tables and graphs. The Tables and the graphs should be clearly labeled and you are required to email me your r programs so that I can check your calculations need be. Your project should consist of at least the following items:

1 Summary

In this section you should give a summary of your main results

2 Descriptive Statistics

In this section you report sample statistics (Means, standard deviations, Skewness Coefficients, Kurtosis Coefficients) and comment of your results. You should also plot your monthly prices and returns and comment on these plots. You need in particular to check for any unusually large or small returns and to identify any news events that may explain them? You should also provide an equity curve for each asset (that is, a curve that shows the growth of a \$1 in each of the asset over the time period you chose) and comment of your results. You should do the same for S&P 500 and compare it with the assets. Create histograms, boxplots and qq-plots for each return series and comment. Run a test for stationarity (see hw 7). Do the returns look normally distributed ? Are there any outliers in the data? Fit different distributions to your data, which one fits better? Construct pairwise scatter plots between your assets returns and comment on any relationships you see. You should also compute the sample covariance matrix of the returns on your assets and comment on the direction of linear association between the asset returns.

3 Portfolio Theory:

Compute the minimum variance portfolio (mvp) and estimate its mean return and its standard deviation. Comment on the weights of this portfolio and annualize the monthly mean and risk by multiplying the mean by 12 and the risk by the square

root of 12. Comment on these values relative to those of each asset. Assume that you have \$100,000 to invest. For the mvp, determine the 5% value-at-risk of the \$100,000 investment over a one month investment horizon. Compare this value to the VaR values for the individual assets. Repeat this with the added restriction that short-sales are not allowed, and calculate the expected return and risk of this portfolio. Using the estimated means, variances and covariances computed earlier, compute the efficient portfolio frontier, allowing for short sales, for the risky assets using the Markowitz approach (we have done this in one of the hws and the program was sent to you). Compute the expected return, variance and standard deviation of the tangency portfolio. Obtain the value of Sharpe's slope for each asset as well as for the tangency portfolio. Which asset has the highest Sharpe ratio? Compute the tangency portfolio when short-sales are not allowed. Compute the expected return, variance and standard deviation of the tangency portfolio. Obtain the Sharpe ratio for the tangency portfolio when short selling is not allowed and compare this tangency portfolio with the tangency portfolio where short-sales are allowed.

4 Asset Allocation:

Suppose you wanted to achieve a target expected return of 6% per year (which corresponds to an expected return of 0.5% per month) using only the risky assets and no short sales, what is the efficient portfolio that achieves this target return? How much is invested in each of the assets in this efficient portfolio? Compute the monthly risk on this efficient portfolio, as well as the monthly and 5% value-at-risk and expected shortfall based on an initial \$100,000 investment. Now suppose you wanted to achieve a target expected return of 6% per year (which corresponds to an expected return of 0.5% per month) using a combination of T-Bills and the tangency portfolio (that does not allow for short sales). In this allocation, how much is invested in each of the six assets and how much is invested in the risk free asset? Compute the monthly risk on this efficient portfolio, as well as the monthly and 5% value-at-risk and expected shortfall based on an initial \$100,000 investment. Compare this with the VaR computed from the allocation of risky assets without short sales.

5 Principal Component Analysis:

Compute the sample correlation matrix of the returns on your assets. Which assets are most highly correlated? Which are least correlated? Based on the estimated correlation values do you think diversification will reduce risk with these assets? Run the PCA analysis and comment on your results.

6 Risk Management:

Assume that you have \$100,000 to invest. For each asset, estimate the 5% value-at-risk of the and expected shortfall on \$100,000 investment over a one month investment horizon based on the normal distribution using the estimated means and variances of your assets. Do the same using the nonparametric method we discussed in class. Which assets have the highest and lowest VaR at a one month horizon? Which assets have the highest and lowest expected shortfall at a one month horizon?

Use the bootstrap to compute estimated standard errors and 95% confidence intervals for your 5% VaR estimates.

7 Copulas:

Use copulas to model the joint distribution of the returns. Which copula fits better the data?