Graded Problem Set

The problem set requires you to analyse data in Excel (or preferred software, see note below) to compute various metrics. Your submission for this assignment should include the excel file in which you performed these calculations as well as a report in the form of a pdf in which you provide written answers to the problem set questions. When answering the questions explain all the steps that you took to get to the solution, including the mathematical representation of formulas you used, Excel formulas or a print screen of settings if using non-formula functionalities of Excel.

If you use different software to analyse the data, clearly specify which software it is and provide the full code that you used for answering the questions.

The attached Excel file includes monthly data on historical prices of 3 stocks (Tab "Stock Prices"), historical index levels for S&P 500 (Tab "Market Index") and the risk free rate of return (Tab "Risk Free Rate"). Assume that the borrowing rate for a typical investor is the risk-free rate plus 2% spread.

a) Find the covariance matrix between the three stocks. Explain the method that you used to compute the covariances. Discuss whether alternative methods are available and provide the pros and cons of using the method you chose. [10 points]

b) Compute the historical Sharpe ratios for the following portfolios. [5 points]

Portfolio	Weight in Apple	Weight in Amazon	Weight in GE
A	33.33%	33.33%	33.34%
B	40%	40%	20%
C	25%	25%	50%

c) Suppose that the optimal risky portfolio offers the expected excess return of 10% and has a variance of 30%. Consider the following 3 investors. What are the portfolio weights that each of them would invest into the optimal risky portfolio? [10 points]

Investor	Utility function
X	U= E(r)-Var(r)
Y	U= E(r)-2 Var(r)
Z	U= E(r)-0.1 Var(r)

d) Suppose that the single factor APT model holds. Find the expected return of the three stocks if the expected excess return of the market next month is %. Explain all the steps that you took in getting to the answer. [15 points]

e) Identify a factor (or factor tracking portfolio) which would be useful to use in addition to the market return. The factor should be something other than SMB,

HML, or WML, and you can find such a factor by consulting academic papers such as those we discussed in class. In light of the "factor zoo" problems studied by Harvey, Liu, and Zhu (2016), explain why you believe this factor's predictive power is statistically significant.

f) Give either a rational (risk-based) or behavioral explanation for your new factor's predictive power. Do you think the factor betas for Apple, Amazon, and GE would be positive or negative? Which of those three stocks do you think would have the highest or lowest betas with respect to your factor? Explain your answers.