FN452: Asset Management and Portfolio Analysis

Practice problems for final exam (Solutions guideline)

1. (17 points) Answer the following questions.
   1.1 (3 points) what is meant by an indexing portfolio strategy, and what is the justification for this strategy?
   1.2 (3 points) Compare sampling and full replication portfolio construction processes.
   1.3 (3 points) Briefly describe **three** techniques considered active equity portfolio management strategies.
   1.4 (3 points) Define and discuss the weak-form EMH. Describe the two sets of tests used to examine the weak-form EMH.
   1.5 (5 points) Describe how you would compute the abnormal rate of return for a stock for a period surrounding an economic event.

   This problem is quite straightforward.

2. (12 points) Select one mutual fund or ETF from the U.S. market. Explain key features and past performance of the fund. Use data from **Yahoo Finance website** to conduct style analysis using appropriate ETFs as your independent variables.

   - Start by select one mutual fund or ETF and explain key features, e.g. fund objectives, strategies, universe of investments. And report past performance of the fund.
   - A mutual fund or ETF could have an effective benchmark measured by using a style analysis. "Style benchmark portfolio" or "style indices" which is passive investments in different styles are deployed as a benchmark. The purpose of the analysis is to create a portfolio whose returns are most similar with those of the active fund, minimizing squared errors of the returns. The performance from an active fund can also be (1) from the styles/factors and (2) from the alpha or the stock selection skills. Then, the multi-factor model is used where the factors (betas) are replaced by style indices as in the following formula.

$$R_{i,t} = \alpha_i + \beta_{1,i}R_{1,t} + \beta_{2,i}R_{2,t} + \cdots + \beta_{k,i}R_{k,t} + \epsilon_{i,t}$$

   - An Excel and calculation process is as follows:
     1. Find the closing price of those 4 funds on Yahoo Finance
     2. Calculate the returns of all portfolios by using the simple return calculation

$$R_t = \frac{I_t}{I_{t-1}} - 1$$

     3. After that, calculate the fitted value in order to create a portfolio that incorporates such investment styles. This can be done by multiplying the random weights of each style with their returns and plus the alpha, the result of which is the returns of the fittest portfolio.
     4. Calculate the return difference between the active and the fittest portfolios and square them to obtain the squared errors term
     5. Lastly, use Solver to determine the weight of each style indices' portfolio and the alpha to achieve the lowest squared errors terms (objective). The constraints are that each can't be negative number and sum of the weights must equal to 1.

     Then report the proportion results. Make sure each proportion sums to one.

4. (15 points) A fund manager in an asset management company have been asked to set up three portfolios **on December 31, 2018.** The fund's investments are to be made in **six stocks**, with allocation as shown in **the Excel file "Thai stock and market data_202012_Update" Sheet "Problem 4"**.
   a) Portfolio A: The optimal risky portfolio (with at least 10% in each asset)
   b) Portfolio B: The equal-weighted portfolio
   c) Portfolio C: The optimal active portfolio, incorporating the analyst forecasts of performance (short-sale not allowed)

   Evaluate performance of these three portfolios over the following 24 months using portfolio performance measurements (e.g. Sharpe ratio). **Compare and contrast** these three portfolio performances. Assume no portfolio rebalancing.

   First, compute the return of each stock during each period from the stock price data using [(New price / Old price) -1]. After computation, we simulate each portfolio at the end of December 2018, with 100 dollars of total investment, each stock will be allocated according to the description. (Port A 26.5% in PTT = $26.5 allocation on the first day) Then each stock investment will grow at the rate that is computed in the first step according to each stock performance. (PTT in Port A is $26.5 on December 2018, it changes 5.04% during January 2019, so on the end of January 2019, the total value of PTT in Port A would be $28.10) The process continues until end of December 2020. The total value of stocks in each fund are calculated and the total value of fund would be aggregation of the stocks' value in each fund. The stock investment proportion on 31 December 2020 could be compute by each stock's value divided by total fund value. (Value of PTT in Port A / Total Port A's value = % allocation of PTT in Port A)

Compute the return column of each fund and market return in each period. From previous question, the total value of the fund in each period have been calculated so we can compute return.
- The risk-free rate is computed with average risk-free rate during the 24 periods.
- The return of funds and market are computed by arithmetic mean of the 24 periods.
- Total risk is calculated by using function sample variance in Excel.
- The Beta of each fund is calculated by function slope in Excel.
- Alpha of each fund is calculated by function intercept in Excel.
- Systematic risk is calculated by squared the Beta and multiplied with market's total risk (Variance).
- Sharpe ratio is calculated by this formula [Return – Risk-free rate]/ Squared root of (Total risk or Variance)
- Treynor ratio is calculated by [Return – Risk-free rate]/Beta of each portfolio
- Jensen's Alpha is the same of alpha obtained previously with intercept function
- Information Ratio is obtained by Alpha/ Squared root of Non-systematic risk, both values is calculated in previous steps.

	Port A	**Port B**	**Port C**
Avg return (monthly)	0.0420%	-0.1117%	-0.1159%
Total risk (Variance, monthly)	0.3112%	0.3654%	0.3404%
Alpha	-0.0949%	-0.2621%	-0.2581%
Beta	73.8523%	81.1333%	76.6985%
Systematic risk (monthly)	0.2730%	0.3295%	0.2945%
Non-systematic risk (monthly)	0.0382%	0.0359%	0.0459%
Sharpe	-0.0080	-0.0328	-0.0347
Treynor	-0.0006	-0.0024	-0.0026

Jensen's alpha	-0.0009	-0.0026	-0.0026
Information ratio	-0.0486	-0.1384	-0.1204

The Sharpe ratio is showing how much excess return the fund could provide with one incremental unit of risk. Port A performs better than Ports B and C. The Treynor ratio is implied the excess return in the incremental unit of systematic risk. Port A still performs better with higher ratio of -0.0006. The Jensen's alpha indicates the abnormal return the fund could yield more than the CAPM (or index model, if you choose index model instead of CAPM), Port A also performs better as it has higher alpha. Lastly, the information ratio is the abnormal return obtained by the incremental unit of non-systematic risk. Port A is also better in this aspect. Overall, Port A is clearly better than Ports B and C as all the ratios suggest superiority.

5. (20 points) Answer the following questions using **the Excel file used in class**.
   5.1 (10 points) Construct an index portfolio on **December 31, 2020**. Use stratified sampling approach with 150 stocks. Set constraints in the same manner as we performed in class.
   5.2 (10 points) Construct an index portfolio **without a capitalization constraint** on December 31, 2020. Use stratified sampling approach with 150 stocks. Set the other constraints in the same manner as we performed in class.

   Same as workshop done in class.

6. (8 points) Shown below are the investment weights for the securities held in four different portfolios: three mutual funds and the benchmark index that each of those funds uses.

	% Security investment weight:			
Security	Benchmark index	Fund X	Fund Y	Fund Z
1	10%	12%	40%	11%
2	10	13	0	9
3	10	8	5	9
4	10	15	0	9
5	10	7	0	11
6	10	10	0	11
7	10	5	30	9
8	10	14	0	11
9	10	6	0	11
10	10	10	25	9

   6.1 (5 points) Calculate the active share measure for Fund X, Fund Y, and Fund Z relative to the benchmark index.
   - Calculate the active share of each fund based on the formula

$$Active\ share = \frac{1}{2}\sum_{i=1}^{N}|w_i - w_{Bi}|$$

   Fund x active share = 14%, Fund Y = 65%, Fund Z = 5%

6.2 (3 points) Using these active share calculations, indicate which fund is the most likely to be considered: (i) a passive index fund, (ii) a closet index fund, and (iii) an actively managed concentrated stock-picking fund. Explain the reason for your classification.
Based on the active share measures,
Fund X: Closet index fund
Fund Y: Actively managed concentrated stock-picking fund
Fund Z: Passive index fund

7 (7 points) My pension plan will pay me $8,000 once a year for a 15-year period. The first payment will come in exactly five years. The pension fund wants to immunize its position.
7.1 (3 points) What is the duration of its obligation to me? The current interest rate is 10% per year.
7.2 (2 points) If the plan uses 5-year and 20-year zero-coupon bonds to construct the immunized position, how much money ought to be placed in each bond?
7.3 (2 points) What will be the face value of the holdings in each zero-coupon bond?

7.1 The duration can be calculated from the following formula.

$$D = \frac{\sum_{t=1}^{T} \frac{t \times CF_t}{(1+y)^t} + \frac{T \times Par}{(1+y)^T}}{P}$$

Therefore, in this case, the duration is 10.28 years.

7.2 The duration of bond portfolio has to be equal to the duration of obligation in order to immunize the position.
10.28 = W*5 + (1-W)*20, where W is the weight in 3-year bond.
Solving the equation W = 64.8% so the pension fund should put 64.8% in 5Y bond and 35.2% in 20Y bond.
In monetary term: 64.8% * 41,560 (the present value of all cashflow) = $26,934 in 5YR bond
35.2% * 41,560 = $14,626 in 20YR bond

7.3 Face value of each bond is…..
5YR bond = 26,934 * 1.10^5 = $43,378
20YR bond = 14,626 * 1.10^20 = $93,399

8 (7 points) Find an active equity strategy on the Internet.
8.1 (2 points) List the strategy's investment objectives.
8.2 (2 points) Identify the portfolio construction process.
8.3 (3 points) List the strengths and weaknesses of the process.
This problem is quite straightforward.