Mini Project

1 Introduction

Beating the market consistently is a holy grail of any fund manger. In the context of stocks, and following the standard market practice, we take the S&P 500 index (yahoo!finance symbol SPX) as the market portfolio.

This mini project tests your understanding of the practical knowledge gained from this course by analyzing 10 stocks assigned to you.

2 Objectives

The main objective of this mini project is to help you acquire the skill to construct and to measure the stock portfolio performance and risk.

3 Data

From finance.yahoo.com, I have downloaded daily times series of US stocks, SPX, as well as risk-free rates from French's data library. The data set will be provided to you as a zip file.

The sample period is from January 1992 through May 2023, a total of 31 years and 5 months.

4 Requirement A

You need to find out the information about the company officers and their salaries. Give also a summary of the profile of each company.

5 Requirement B

- Obtain monthly index levels from daily index levels by resampling end-of-the-month prices.
- Since SPX is the benchmark, you need to obtain SPX at the monthly frequency with the same sample period.
- Also, you need to align the monthly risk-free rates from French's library.

6 Requirement C

You are required to construct a price-weighted index with the initial value of 100 with the ten stocks assigned to you. Obviously you need to plot your price-weighted index.

The benchmark index is the S&P 500 index. How do you compare your index with the S&P 500 index?

7 Requirement D

Your price-weighted index should have ($31 \times 12 + 5 = 377$) months of data points. Compute the simple returns. Let r_i, $i = 1, 2, \ldots, n$ be the returns, where n =376. The following quantities are to be computed:

1. Average monthly return $\widehat{\mu} = \dfrac{1}{n}\sum_{i=1}^{n} r_i$
2. volatility $\widehat{\sigma} = \sqrt{\dfrac{1}{n-1}\sum_{i=1}^{n}\left(r_i - \widehat{\mu}\right)^2}$
3. t statistic with respect to the null hypothesis $\mu = 0$:
$$t_{n-1} = \frac{\widehat{\mu}}{\frac{\widehat{\sigma}}{\sqrt{n}}}$$
4. Excess return with respect to the benchmark return b_i is $e_i = r_i - b_i$, where b_i is the monthly return of S&P 500 index. The average excess return is $\widehat{e} = \dfrac{1}{n}\sum_{i=1}^{n} e_i$.
5. Tracking error $\widehat{\sigma}_e = \sqrt{\dfrac{1}{n-1}\sum_{i=1}^{n}\left(e_i - \widehat{e}\right)^2}$
6. Information ratio IR $= \dfrac{\widehat{e}}{\widehat{\sigma}_e}$
7. Sharpe's ratio SR $= \dfrac{\widehat{\mu} - \widehat{r}_f}{\widehat{\sigma}}$, where $\widehat{r}_f$ is the average of the monthly risk-free rate $r_{f,t}$
8. M^2, M2, or Modigliani-Modigliani measure
$$\text{M2} = \text{SR} \times \widehat{\sigma}_b + \widehat{r}_f,$$
where $\widehat{\sigma}_b$ is the volatility of the benchmark (S&P 500)
9. Jensen's alpha $\widehat{\alpha}$
Run time series regression inspired by the Capital Asset Pricing Mode to find $\widehat{\alpha}$:
$$r_{p,t} - r_{f,t} = \alpha + \beta\left(r_{m,t} - r_{f,t}\right) + \varepsilon_t$$
10. Also, find Beta $\widehat{\beta}$
11. t statistics for $\widehat{\alpha}$ and $\widehat{\beta}$
12. Treynor's ratio TR $= \dfrac{\widehat{\mu} - r_f}{\widehat{\beta}}$
13. Run the variance ratio test for $q = 2, 3, 4, 5$. You need to transform your simple return r_i to log return ℓ_i by the following formula:
$$\ell_i = \ln(1 + r_i)$$

8 Requirement E

You will need to present your analysis in slides. In your slides, you need to have charts, tables, and description.

The return, volatility, tracking error, information ratio, Sharpe's ratio, M2 ratio, are to be reported in annualized terms.

Obviously, your presentation slides must have at least introduction, statement of hypotheses and assumptions, empirical finding, discussion, and conclusion.

Next week is your showtime. Each student will present for 10 minutes, with 3 minutes for Q&A, and 2 minutes for turnover.