FN 4329: INVESTMENTS AND PORTFOLIO MANAGEMENT

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1   Question 1

Decide on the allocation of your budget to each of the above instruments. Rationalize your choice based on your own investment philosophy. You should fill out a risk tolerance questionnaire and supply both the questionnaire and its suggested allocation (in the project's Appendix). In your discussion, please explain the choice of your investment vehicles and their significance in your portfolio. Label this as your investment policy statement (IPS).

2 Question 2

Outline your investment objectives, constraints and strategies and discuss the relative importance of risk and return in your investment decision making.

3   Question 3

Provide a preliminary discussion of the effects of the short investment horizon in your decision(s) and diversification strategy

4   Question 4

Compute the descriptive statistics for each instrument. Explain each metric you computed from the perspective of the investor. Provide graphs as well.

5   Question 5

Compute additional metrics for the assets such as the correlation and covariance matrices, for the entire and two subperiods (of your own choosing), if needed. Interpret your findings. Also, compute each fund's alpha, beta, R-square. Interpret your findings from the perspective of the investor

5.1   beta

The beta coefficient measures the systematic risk of an individual stock compared to the market risk, also called unsystematic risk. The beta formula is:

$$\beta = \frac{\text{cov}(R_e, R_m)}{\text{var}(R_m)} \tag{5.1}$$

where R_e is the return of the individual stock and R_m is the return of the overall market. In order to calculate β, a regression model has to be fitted on the data points from an individual stock's returns against those of the market. Then β is the slope of the aforementioned line.

Even though the formula is straightforward, the data selection is not. The result depends on the time frame and frequency of historical data selected. Hence, many different β values can be found online. We use the `Yahoo Finance` model: 3 years of monthly data. To be more specific, let $\mathcal{D} = \{d_0, d_1, \ldots, d_{36}\}$ be the closing prices of the individual stock. Then, $\mathcal{P} = \{p_1, \ldots, p_{36}\}$ is the set of the percent changes of said closing prices where $p_i = \frac{d_i - d_{i-1}}{d_{i-1}} \times 100\%$. Note that $\mathcal{P} = R_e$ (see (5.1)). By the same token, R_m is calculated using the historical closing prices of the market index (`GSPC`). Using these data points and equation (5.1), β is calculated.

5.2   alpha

By finding β we can proceed to calculate α. To be more precise α denotes the excess return. The Capital Asset Pricing Model (CAPM) is given by:

$$\mathbb{E}(R_i) = R_f + \beta_i(\mathbb{E}(R_m) - R_f) \tag{5.2}$$

where $\mathbb{E}(R_i)$ is the expected return of the indvidual asset, R_f is the risk-free rate. Then, α is calculated by substracting the expected returns from the actual mean portfolio returns $\bar{R}$:

$$\alpha = \bar{R} - \mathbb{E}(R) \tag{5.3}$$

5.3   R-squared

R-squared or coefficient of variation is calculated using the following formula:

$$R^2 = 1 - \frac{\text{Explained Variation}}{\text{Total Variation}} \tag{5.4}$$

R^2 is a statistical measure that indicates the proportion of the variation of dependent variable that can be explained using the independent variables of a simple regression model. An illustrative explanation is adduced using the following figures. In 1a a simple regression model is fitted using the data provided. The explained variation is the sum of the squared distances from the regression line divided by the number of points. Said distances are denoted with a blue color in the figures below. The total variation is calculated by the same token but with a crucial difference: the line is horizontal and denotes the mean of the data.

In economics, the R^2 measure denotes the percentage of a fund's movements that can be explained away by the historical changes of the benchmark index.

(a) Explained Variation

(b) Total Variation
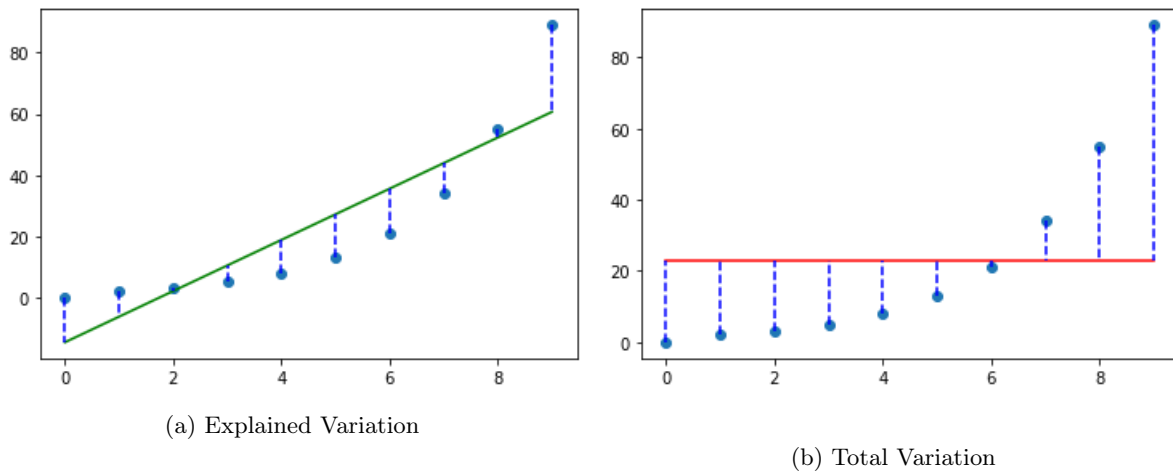
Figure 1: R-squared calculation

5.4   Shapre ratio

The Sharpe ratio is named after Nobel Laureate William Sharpe. It is a measure that relates the return of an investment to its risk; it is the risk-adjusted return.

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p} \tag{5.5}$$

where

- R_p = return of mutual fund

- R_f = risk-free rate

- σ_p = standard variation of the portfolio's excess return

The calculation of the Sharpe Ratio using `Excel` uses "the trailing three-year period by dividing a fund's annualized excess returns over the risk-free rate by its annualized standard deviation"[1].

Using the historical data for each fund and the analysis presented above, we are able to calculate α, β, R^2 and the Sparpe Ratio using `Excel`. The results are presented below:

	VGPMX	VHGEX
alpha	-0.78 %	-1.07 %
beta	0.76 %	1.13 %
R-squared	0.10 %	0.88 %
Sharpe Ratio	0.06 %	0.52 %

Methodology   Historical data of a 5-year time frame with monthly intervals were used for the above calculations. The index fund used for stock mutual funds is ACWI, as stated in MorningStar.

Risk-free Rate   To compute the Risk-Free rate, 1-Year Treasury Constant Maturity Rate was used (5 year average with monthly intervals).
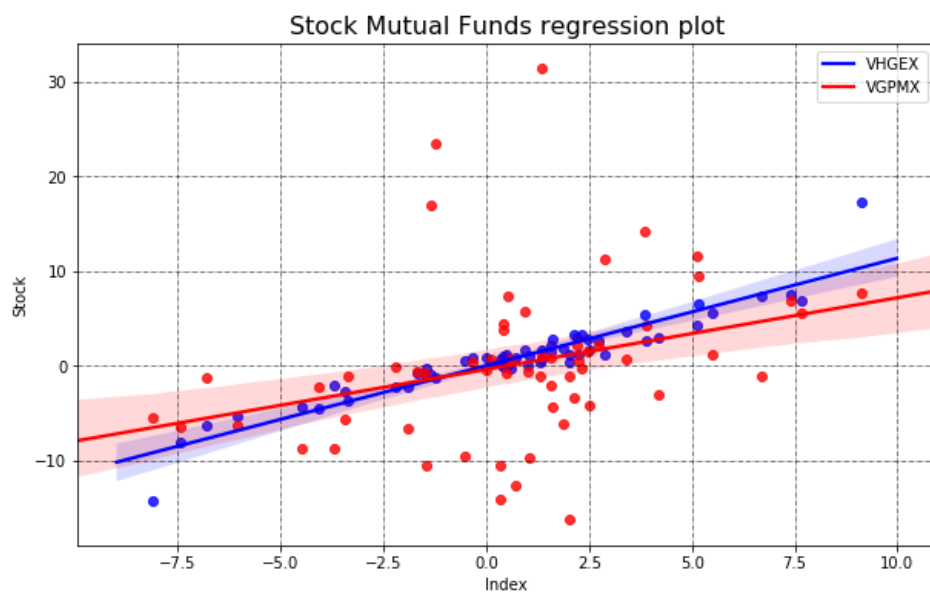
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[1] link

Figure 2: Stocks Regression Plot

6 Question 1

Calculate the return/risk of your risky portfolio. Explain each step in your analysis. You must use **EXCEL's mmult functions** for this part of the analysis.

7 Question 7

Derive and graph the Capital Allocation Line. Graph the Efficient Frontier with your available investment instruments (assets) and superimpose your CAL. Discuss the various options you may have and finalize your optimal point.

8   Question 8

Keep a track record of the macro- and microeconomic events that influenced your assets/portfolio and offer explanations for some of them, if you deem necessary. Your explanations should also be accompanied with some quantitative verification.

9   Question 9

Measure and evaluate your overall portfolio's performance and compare it with the passive investment strategy. In this step, you should apply EXCEL's Solver to evaluate several possible outcomes (in terms of risk and return) and explain each outcome. In that endeavor, compute the various performance measures we have learned. Decide on the best outcome for you. Discuss.

10   Question 10

Finally, perform a critical evaluation of the project. In other words, what did this project accomplish for you regarding the study and (this simple) application of investment theories and strategies? What would be the implications of constructing, managing and evaluating such a portfolio for your portfolio?

References

[1] Nikiforos Laopodis. *Understanding investments: Theories and strategies*. Routledge, 2012.

[2] *Yahoo Finance*. URL: https://finance.yahoo.com/.

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[8] *Morgan Stanley Investment Management*. URL: https://www.morganstanley.com/im/en-us/financial-advisor.html.