



MGT 301: Foundations in Financial Economics

Autumn Semester 2025

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Homework 2

Instructions

- The homework consists of two parts.
- It is due 18.11.2025 before class, i.e. Moodle submission closes on this day at 13:15. The homework needs to be typed and must be uploaded on Moodle using the provided link. In case (and only in case!) you have any issues with that, please send your files to luiz.bissoto@epfl.ch
- Hand in (1) a write-up in the .pdf format, presenting your results and explaining your computations when necessary, and (2) an excel file with your computations. Keep the write-up concise.

Part 1: Mean-Variance Frontier

*You are free to choose any coding language, IDE or plotting package if you are not familiar with Excel as long as your report is readable and results are clear. I will post the solutions as an Excel spreadsheet. I suggest doing the homework in Excel because, in this case, you do not have to re-derive formulas and show plots in the write-up. You can create multiple sheets, i.e. "SPY" and "IEF" with downloaded data, and the "main" sheet, where you can import historical adjusted close prices from "SPY" (and "IEF") using a **SPY!{cell_location}** reference, and complete the exercise.*

Download weekly data on the SPY ETF (NYSEArca: SPY), on the VOO ETF (NYSEArca: VOO), on the ishares MSCI Switzerland ETF (NYSEArca: EWL), and the iShares 7-10 Year Treasury Bond ETF (NASDAQ: IEF) from 01/01/2013 (if available) through 30/06/2025. An easy way of doing so in Python is with:

```
import yfinance as yf

weekly = yf.Ticker('VOO').history
(start="2013-01-01", end="2025-06-30", auto_adjust=True)
['Close'].resample('W').last()
```

You need, of course, to adjust the ticker to the ones you need. These two lines of code will already give you the prices adjusted for dividends, at the closing week price, in the date range you will need. You are **not** mandated to use this, though; you are free to use **any source** of your choosing for stock prices. For instance, [investing.com\[...\].vanguard-s-p-500-historical-data](#) is a reliable alternative. Again, these are just suggestions; use any source you are comfortable with.

Throughout the exercise, assume the annual risk-free rate over the period was constant at 1.5%.

1. For each ETF, give the names of the 10 largest holdings¹ and how much of the market capitalization of each index is represented by these 10 holdings, and give their expense ratio.

¹This data is easily retrievable through a standard web search.

2. Run a regression of SPY onto VOO for the period that you have data on both. When you compare both ETFs what do you conclude is the main difference between the two? If you had the choice which would you pick? How can you explain that both are still very widely held and that VOO is recently catching up to SPY in terms of assets under management?
3. Since we have a longer time series available for SPY we will focus on that one for the remaining of our analysis (and drop VOO).

Estimate the annualised expected return and standard deviation for each ETF (SPY, IEF, EWL), as well as the annualised pair-wise correlations.² *Bonus: IEF is a treasury bond ETF, however, the standard deviation of IEF returns is not zero, and this ETF is not risk-free. Briefly discuss possible causes why a treasury bond ETF is not risk-free.*

4. Compute the weights in the three risky ETFs in the Tangency portfolio as well as the mean, variance, standard deviation, and Sharpe ratio of the tangency portfolio.
5. Plot the mean-standard deviation frontier you can achieve by combining the three risky ETFs (SPY, EWL, IEF) and the risk-free asset.
6. Suppose you want to target an annual volatility of your portfolio return of 15%. What is the optimal weight you should hold in the three risky ETFs? What is your implied risk-aversion coefficient?
7. For the optimal portfolio you determined at the previous question, give its annualized expected return, and annualized Sharpe ratio.
8. What do the results suggest about a Swiss investor who only holds the Swiss stock market and cash. Should she diversify internationally?
9. **Bonus Question:** Do you think the "optimal" allocation you obtain is consistent with an equilibrium for a Swiss investor? What do you think drives your findings? Suppose a Swiss investor wants to invest at least 50% of her wealth in the Swiss stock market. What would be her optimal allocation with the same target expected return in that case?

Part 2: Questions on the CAPM

Please provide a short explanation along with your answers.

1. The CAPM implies that all stocks with the same variance have the same expected return. True or False?

²To annualise the estimates, recall that you need to multiply the estimates based on weekly returns of the mean, variance, and covariance by 52.

2. The CAPM implies that two securities with different levels of idiosyncratic risk must have different expected returns, otherwise no agent would choose to hold the security with higher idiosyncratic risk. True or False?
3. The beta of UBS to the world-market portfolio is 1.3 and its annualized volatility is 35%. Given that the market volatility is 15%, decompose UBS' annual volatility into its component due to idiosyncratic risk versus that due to systematic risk?
4. Suppose that when you regress MOJO's hedge fund return on the market portfolio return, you find that MOJO has a statistically significant positive alpha of 1% per month. Does this mean MOJO is underpriced and that you should therefore invest all of your wealth in MOJO?
5. Why is beta a better measure of risk than volatility (or variance) according to the CAPM?
6. You are running a very successful set of ventures across Switzerland and Germany focused on real-estate development and hotels. Suppose you are considering investing your profits in one of two large scale new projects: (i) a bridge infrastructure project in Australia, (ii) large five-star hotel in the heart of Zurich. Your analysts have performed a traditional cash-flow analysis and estimated the Net Present Value of both investments by discounting the expected future cash-flows of each of the projects at the risk-free rate. They find that both projects have roughly the same net present value of 55 million CHF. What would be your advice about which project to select?