↗ lesson 09

CAPM and Portfolio Management

Python for Financial Analysis
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Syllabus Review

1 Introduction to Python: Python in Finance

2 Python Basic Syntax: Importing Libraries

3 Working with Pandas

4 Pandas Underneath the Hood: Working with NumPy

5 Data Wrangling and Visualization

6 Extracting Financial Insights from Charts and Graphs

7 Financial Calculations with Python: Part 1

8 Financial Calculations with Python: Part 2

9 **CAPM and Portfolio Management**

10 Linear Regression

11 Time Series Analysis

12 Algorithmic Trading

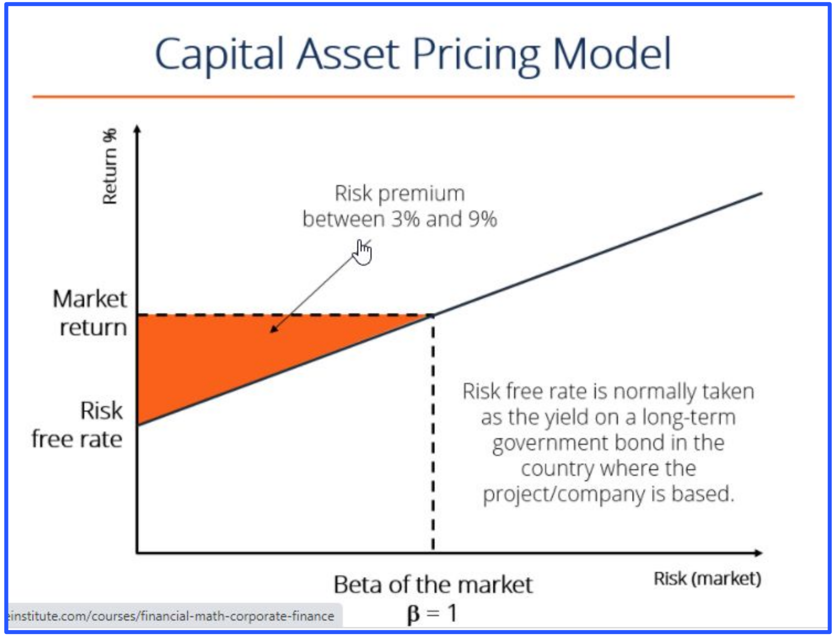
+ **Bonus Class:** Cryptocurrency Beyond the Basics with a Fintech Guest Speaker

Class agenda

- CAPM concepts
- The brass ring of increasing returns and lowering risk
- What is the efficient frontier?
- Calculating and graphing the CAPM (Capital Asset Pricing Model) of your portfolio
- Pythonic: Tuples and subclass namedtuples

The Capital Asset Pricing Model

- CAPM takeaways:
  a. Diversification can lower *unsystematic* risk
  b. Rs = Rf + risk premium
  c. Rs = Rf + βs (Rm – Rf)
  d. More risk implies more reward



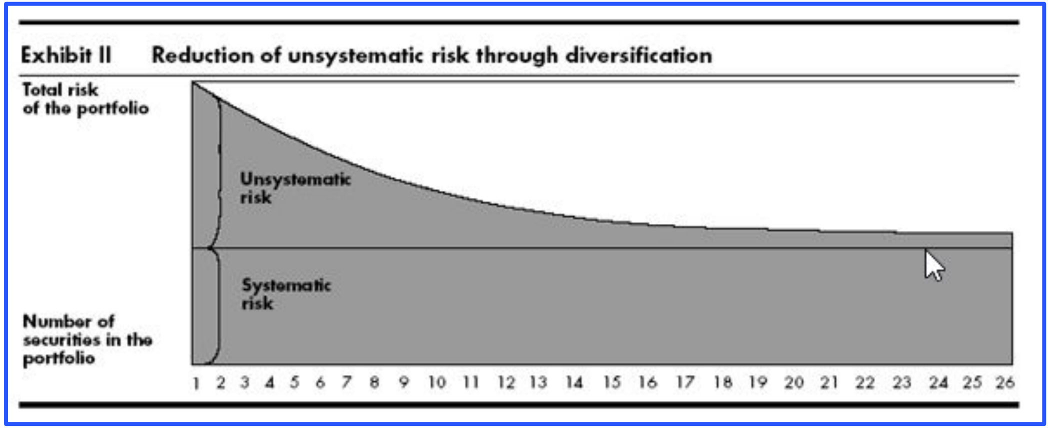
Capital Asset Pricing Model

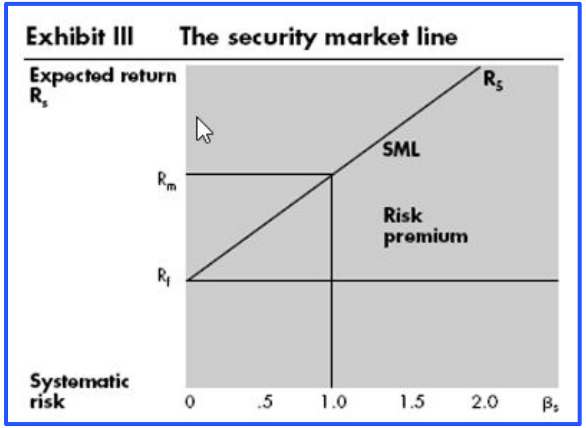
Risk free rate is normally taken as the yield on a long-term government bond in the country where the project/company is based.

einstitute.com/courses/financial-math-corporate-finance

Source: *corporatefinanceinstitute.com*

Does the Capital Asset Pricing Model Work?





Source: Harvard Business Review
by David W. Mullins, Jr.

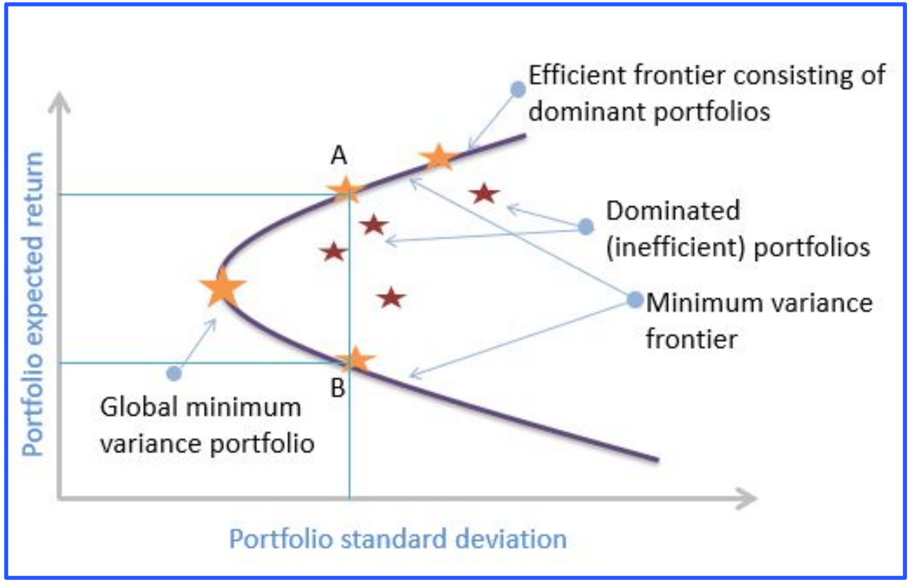
Calculating VaR for a portfolio

- Matrix multiplication: Weights (vector) x cov (matrix) x Weights (transposed vector)
- This is a nightmare in Excel, but a few lines in Pandas and NumPy

$$\sigma_P^2 = \begin{bmatrix} w_1 \cdots w_n \end{bmatrix} \begin{bmatrix} \sigma_{11} & \cdots & \sigma_{1n} \\ \vdots & & \vdots \\ \sigma_{n1} & \cdots & \sigma_{nn} \end{bmatrix} \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = \mathbf{w}'\Sigma\mathbf{w}$$

The brass ring: increasing returns and lowering risk

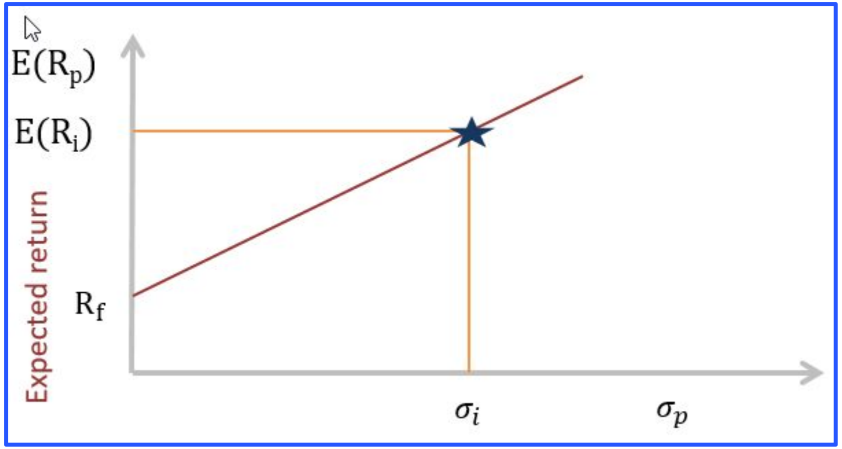
Two assets; graph the expected return vs. the standard deviation

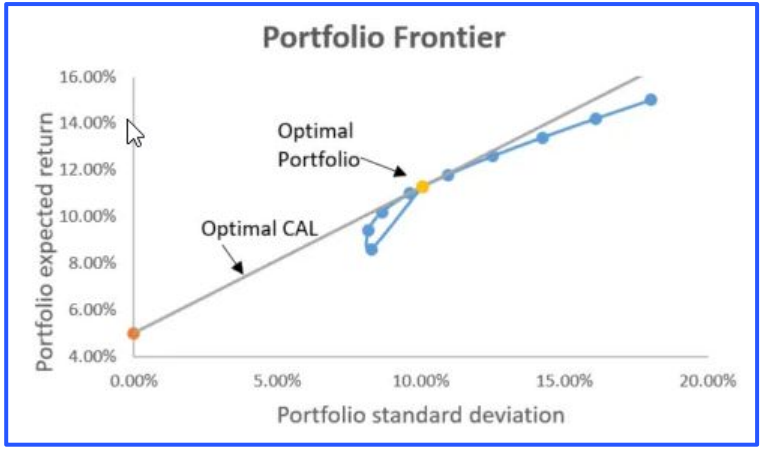


Source: analystprep.com

What is the efficient frontier?

- Vary the weights so that the portfolio has the lowest risk while maximizing return
- Capital Allocation Line starts at Risk-free return and goes to x=portfolio S.D., y=portfolio expected return.





Pythonic: Tuples and subclass namedtuples

- Tuples
  1. Saw them the first module and also with bond prices
  2. We can treat points as a tuple, but must remember x in tangent[0] but y in tangent[1]
- Namedtuples
  1. Saw them briefly in pd.itertuples
  2. Can access fields with . notation
  3. Can initialize dataframes

Assignment #9

Analyzing five to seven stocks, and determine their expected returns and volatilities. (Lifehacker nudge: You might want to use your company's retirement IRAs.) Construct two portfolios with high return (and high risk), and low return (and low risk). Your challenge: Can you come up with a third portfolio with a significant risk reduction that only slightly reduces returns?

Go Deeper: Refactor a previous assignment to get familiar with the two subclasses: defaultdict and namedtuples.

Resources

- Capital Asset Pricing Model

  HBR overview: https://hbr.org/1982/01/does-the-capital-asset-pricing-model-work

  Basic: https://corporatefinanceinstitute.com/resources/knowledge/finance/what-is-capm-formula/

- VaR for a portfolio

  Example: https://www.interviewqs.com/blog/value-at-risk

  Dot product: https://numpy.org/doc/stable/reference/generated/numpy.dot.html

- Efficient Frontier

  https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/efficient-frontier/

  https://analystprep.com/blog/evolution-of-portfolio-theory-efficient-frontier-to-sml/

- Namedtuple

  Basic: https://realpython.com/python-namedtuple/

Q&A