lesson 08

Financial Calculations with Python: Part 2

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

- What is a Risk-free rate?
- How a stock varies with the market
- Correlation
- Calculating VaR
- Pythonic: dictionaries, and its subclass defaultdict

What is a Risk-free rate?

- "The risk-free rate of return is the theoretical rate of return of an investment with zero risk."
  A. Why theoretical? Even a US T-bond can default
  B. Can it be negative? What in the world is a negative interest rate?
- US Treasury Bond, 3-month

How a stock varies with the market

- Equation for a line: y = mx + b.
- CAPM says it slightly differently: y = **β**x + **α**

    A. Stock price: y
    B. Movement relative to a benchmark: **β**
    C. Excess return of the stock: **α**
    D. (Food for thought: do you think money managers are rated on **α** or **β**?)

- Calculating non-diversifiable risk, □, from covariance and variance

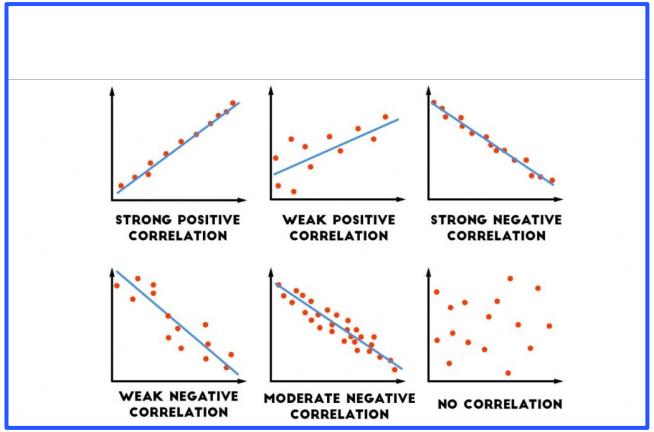
    A. Variance: a measure of the spread of a distribution. The average of the squared deviations from the mean.
    B. Covariance: Covariance indicates the level to which two variables vary together

- Calculating diversifiable risk, **α**

Correlation

- Intuition on correlation
  A. What positive and negative mean
- Pearson's correlation
- Calculating correlation for assets
- Pairs trading

$$r = \frac{\sum_{(} x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{(} x_i - \overline{x})^2 \sum_{(} y_i - \overline{y})^2}}$$



Calculating VaR

- (pitfall: VaR and np.var are not the same!)
- The Big Idea – The odds of losing money: “What’s my worst-case scenario?”
- The three parts
    A. Time period
    B. Confidence level
    C. Loss amount (or percentage)
- Three methods
    A. Historical
    B. Variance-Covariance
    C. Monte Carlo

Pythonic: dictionaries & subclass defaultdic

- What Python course would be complete with lambda, reduce, and map?
    A. Guido's take: "About 12 years ago, Python acquired lambda, reduce(), filter() and map(), courtesy of (I believe) a Lisp hacker who missed them and submitted working patches. But, despite of the PR value, I think these features should be cut from Python 3000."
- Pythonic: All about dictionaries
    A. Defaultdict

Assignment #8

Given a stock index and three tickers from that index, calculate the beta and alpha coefficients for those tickers. (Notes: You'll have to research or calculate deriving alpha from beta. And there are other ways to calculate alpha and beta; you don't have to use mine.)

Go Deeper: Calculate the correlation between several indices and stocks. Discover indices and stocks that are 1) strongly positively correlated 2) weakly negatively correlated and 3) Show no correlation. Display a heatmap of your findings.

Resources
(part 1)

- Risk-free rate

  Basic:
  https://www.investopedia.com/terms/r/risk-freerate.asp

  Reference:
  https://en.wikipedia.org/wiki/Risk-free_rate

- How a stock varies with the market

  Alpha and beta:
  https://www.investopedia.com/articles/investing/092115/alpha-and-beta-beginners.asp

  β
  https://www.wallstreetmojo.com/capm-beta-definition-formula-calculate-beta-in-excel/

  β
  https://www.learnpythonwithrune.org/calculate-the-capm-with-python-in-3-easy-steps/

  α
  https://www.wallstreetmojo.com/alpha-formula/

Resources
(part 2)

- Correlation

  Basic:
  https://www.statisticshowto.com/probability-and-statistics/correlation-analysis/

  Finance:
  https://www.investopedia.com/ask/answers/032515/what-does-it-mean-if-correlation-coefficient-positive-negative-or-zero.asp

  With heatmap:
  https://algotrading101.com/learn/python-correlation-guide/

  Variance:
  https://numpy.org/doc/stable/reference/generated/numpy.var.html

  Covariance:
  https://numpy.org/doc/stable/reference/generated/numpy.cov.html

Resources
(part 2)

- Value at Risk (VaR)

  Big idea:
  https://www.investopedia.com/articles/04/092904.asp

  Risk Engineering slides:
  https://risk-engineering.org/static/PDF/slides-VaR.pdf

- VaR for a portfolio

  https://financetrain.com/analytical-approach-to-calculating-var-variance-covariance-method

Pythonic

- Map, lambda, filter, and reduce

  Guido says:
  https://www.artima.com/weblogs/viewpost.jsp?thread=98196

- Dictionaries

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

  Sorting a dict by value and defaultdict:
  https://stackoverflow.com/questions/613183/how-do-i-sort-a-dictionary-by-value/613218

  Official tutorial:
  https://docs.python.org/3/tutorial/datastructures.html (5.5)

  Defaultdict reference:
  https://docs.python.org/3/library/collections.html

Q&A