Stock Portfolio Optimization and Automation Program

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Outline of Slides

Introduction

1. Basics of a stock portfolio
2. What it means to optimize a portfolio
3. Modern Portfolio Theory and Capital Market Line
4. Spoiler alert: this method isn't mainstream anymore, but it can be very useful

Using Yahoo Finance's API

1. Stock Data from Yahoo Finance's API
2. Package allows infinite number of stock inputs
3. Package easily integrates S&P 500, allowing for broad sample

Manipulating the Dataset I

1. Data cleaning mainly includes formatting issues
2. Added columns for excess return calculation
3. Table 1: Example of the API Export

	date	stockName	stockPrice	stockReturn
1	2020-02-03	MSFT	173.90	0.07
2	2020-03-02	MSFT	172.79	-0.01
3	2020-04-01	MSFT	152.11	-0.12

Manipulating the Dataset II

4. Drops null values for firms who were not publicly traded during date range
5. Pivots data so that excess return on stocks are column variables

Methods I

1. Calculating Excess Returns

$$Returns_{Excess} = Return_{Stock_i} - RiskFreeRate \tag{1}$$

2. Shows abnormal returns beyond United States Treasury-Bill
3. Why the T-Bill? T-Bill's are assumed "riskless" assets because they experience low fluctuations in value and are highly liquid

Methods II

4. Finding Variance and Covariance between Stocks allows for better optimization

$$Variance-Covariance-Matrix = \frac{X^{T}_{ExcessReturns} * X_{ExcessReturns}}{NumberOfStocks_{X_{ExcessReturns}}} \quad (2)$$

Methods III

5. Linear Optimization with rGLPK package
6. Program outputs optimal weights in each stock

	Stock Name	Stock Weight	Dollar Investment
1	ADS	0.51	5144.09
2	IR	0.49	4855.91

7. Note that the program is set to a 10,000 dollar investment, and the "Stock Weight" should be read as percentages.

Methods IV

8. Program outputs standard deviation (risk), expected return, and Sharpe Ratio of the optimized Portfolio

	Value
Risk	0.29
Expected Return	0.15
Sharpe Ratio	0.45

9. Interpretation of Risk: Given the contents of the portfolio, the expected variation in stock prices equal 29 percent

Findings

1. Many alternatives to passive investments
2. Not ideal to use this tool for active investments.
3. According to the Wall Street Journal, you will be beat 90 percent of time by a passive fund.
4. Wall Street's computer algorithms trade in fractions of a second, leaving the individual investor in the dust

Importance of Topic

1. This tool can be used for investment decision making
2. Easily bridges uncertain investors to information, which can be powerful