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# Stock Portfolio Optimization and Automation Program

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# 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

$$Returns_{Excess} = Return_{Stock_i} - RiskFreeRate \quad (1)$$

- 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

$$\text{Variance} - \text{Covariance} - \text{Matrix} = \frac{X_{\text{ExcessReturns}}^T * X_{\text{ExcessReturns}}}{\text{NumberOfStocks} \times X_{\text{ExcessReturns}}} \quad (2)$$



# 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