

0

# Stock Portfolio Optimization and Automation Program

Daniel Carpenter

University of Oklahoma

April 2020

# Outline of Slides

## References

1 Introduction

2 Data

3 Methods

4 Findings

5 Importance of Topic

# 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 SP 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	JPM	1.00	10000.00

# Methods IV

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

	Value
Risk	15.97
Expected Return	0.13
Sharpe Ratio	0.01

# 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