Portfolio Optimization for Commercial Banking Corporation

Blue Team 14
Hardy Agarwal, Justin De La Rosa, Zach Houghtaling, Feliciti Milne, Jane Williford

February 13th 2023

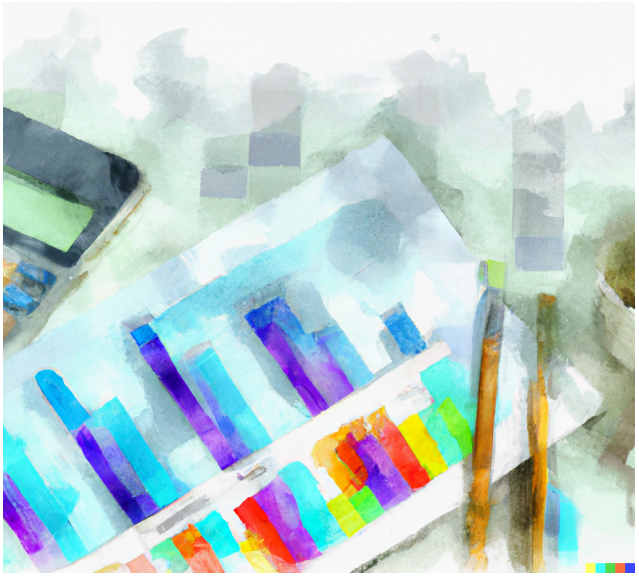

Table of Contents

Portfolio Optimization for Commercial Banking Corporation

Overview

The Commercial Banking Corporation, hereafter the "Bank", is interested in developing a portfolio with five select stocks, using the percent daily returns of the closing prices from January 20, 2022, through January 18, 2023. The stocks of interest include Ross Stores (ROST), Pinduoduo (PDD), Target Hospitality (TH), Ardmore Shipping Corp (ASC), and Glencore Plc (GLNCY). The Bank wants to minimize the daily risk while earning a daily return of at least 0.5%. Our team, Blue 14, recommends using the portfolio breakdown outlined in **Figure 1** below to meet these objectives. This breakdown provides a standard deviation (std) of 2 and a return of 27%, which is well above the requested return rate.

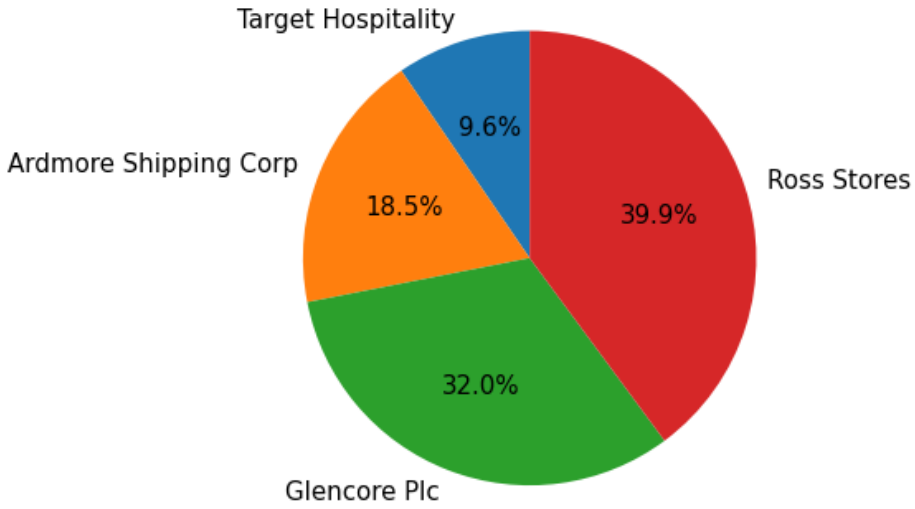

Figure 1: Optimal Stock Portfolio For Low Risk

Pinduoduo is not represented in **Figure 1** because the optimal portfolio to minimize risk does not include any Pinduoduo stocks.

If the bank can tolerate higher risk, we provide information on alternative portfolios that can result in higher returns in **Figure 2** on page 3.

Methodology and Analysis

Data Used

The stock data for Ross Stores, Pinduoduo, Target Hospitality, Ardmore Shipping Corp, and Glencore Plc was pulled from Yahoo! Finance API using Python's yfinance library. The data for the analysis is from January 20th, 2022, through January 18th, 2023. However, we pulled one

extra day, January 19th, 2022, to calculate the percent daily return for January 20th, 2022. We removed the row from the data once the calculation was complete.

Data Preparation

The percent daily return was calculated using the daily close values. The specific formula is in the Appendix under **Equation 1**.

For each stock, the average daily return was subsequently calculated, displayed in **Table 1.** The risk of each stock is represented by historical daily return volatility, or the covariance of the average daily return percentages. The variability of each stock is also listed in **Table 1.**

Table 1: Average Daily Percent Return and Variability of Each Stock

Stock Name	Average Daily Return (%)	Variability of Stock (std)
Ross Stores (ROST)	10.9	8.0
Pinduoduo (PDD)	34.5	45.6
Target Hospitality (TH)	79.9	26.9
Ardmore Shipping Corp (ASC)	61.9	13.4
Glencore Plc (GLNCY)	12.2	7.8

In **Table 1** above, we can see that Pinduoduo has the highest variability with a standard deviation of 45.6. Glencore Plc has the lowest variability with a standard deviation of 7.8. Comparatively, Ross Stores has the smallest average return of 10.9%. Whereas Target Hospitality has the largest average return of 79.9%.

Optimization Development

To determine the optimal proportion of the portfolio to designate to each of the five stocks, we set up and ran an optimization model that minimized risk for a return of at least 0.5%. We also ensured that all of the investment money was utilized. We then evaluated the different portfolio options for different levels of risk using an efficient frontier.

Results

Optimal Portfolio Summary

The optimal portfolio that minimizes risk has 39.9% of the portfolio invested in Ross Stores, 0% in Pinduoduo, 9.6% in Target Hospitality, 18.5% in Ardmore Shipping Corp, and 32% in Glencore Plc. The expected return on this portfolio is 27% with a risk of 2 standard deviations. This mix is shown in the shaded cells with italicized font in **Table 2** on page 3.

Table 2: Mean Daily Percent Return Rate and Variability of Each Stock

Stock Name	Lowest Risk Portfolio (%)	Double Return Portfolio (%)	Triple Return Portfolio (%)
Ross Stores (ROST)	*39.9*	21.3	0.0
Pinduoduo (PDD)	*0.0*	4.0	0.0
Target Hospitality (TH)	*9.6*	27.4	100.0
Ardmore Shipping Corp (ASC)	*18.5*	45.1	0.0
Glencore Plc (GLNCY)	*32.0*	2.2	0.0
RISK (std)	2	2.5	5.2
RETURN (%)	27%	54%	80%

Our team also investigated portfolio mixes that doubled and tripled the expected return. The optimal portfolio mix to double the return of the lowest risk portfolio from 27% to 54% is displayed in the **Table 2** column labeled *Double Return Portfolio (%)*. The optimal portfolio that triples the return of the lowest-risk portfolio from 27% to 80% invests all assets in Target Hospitality, as displayed in the **Table 2** column labeled *Triple Return Portfolio (%)*. However, these rewards are only achieved by increasing the risk. Risk needs to increase from 2 to 2.5 standard deviations to double the expected return. Risk needs to increase from 2 to 5.2 standard deviations to triple the expected return. The rate of change in the returns for different risks is illustrated with the Efficient Frontier in **Figure 2** on page 4.

EFFICIENT FRONTIER

The black line in the Efficient Frontier in **Figure 2** on page 4 displays all optimal returns for various portfolio risks.

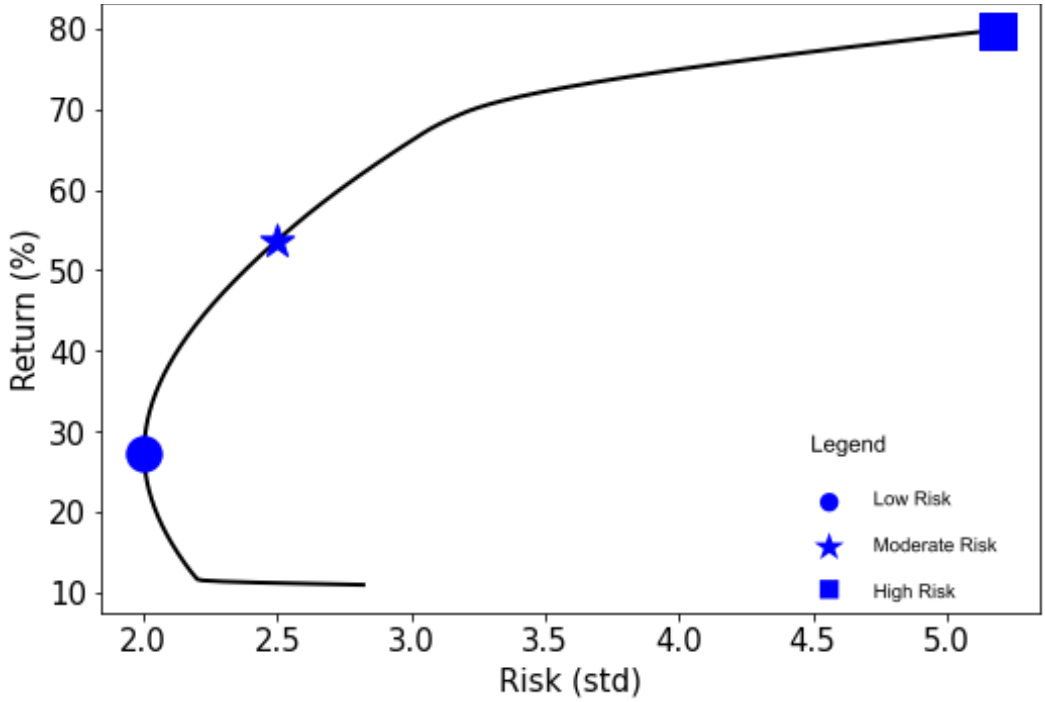

Figure 2: Portfolio Optimization Efficient Frontier

The blue circle, star, and square represent the risk and return for the lowest risk portfolio, the doubled return portfolio, and the tripled return portfolio, respectively. This graph further illustrates how doubling the returns from the minimum only adds 0.5 standard deviations of risk, while tripling the returns requires over three additional standard deviations of risk.

Between these three points, there are endless additional optimal portfolio options, depending on the level of risk an individual may be comfortable with and the percent return they might expect. When deciding which is the best portfolio option, it is important to consider the rate of change in returns for the different risks. As the percent increase in the return levels off, it may be less advantageous to continue to take on more risk.

RECOMMENDATIONS

As outlined in the RFP, if the minimum return is set to 0.5% and the Bank's objective is to minimize, we recommend proceeding with the optimal portfolio consisting of 39.9% in Ross Stores, 0% in Pinduoduo, 9.6% in Target Hospitality, 18.5% in Ardmore Shipping Corp, and 32% in Glencore Plc. However, suppose the average return of 27% is insufficient, and the Bank is willing to increase its risk from 2 to 2.5. In that case, we recommend a portfolio mix of 21.3% Ross Stores, 4% Pinduoduo, 27.4% Target Hospitality, 45.1% Ardmore Shipping Corp, and 2.2% Glencore Plc to double the return from 27% to 54%.

CONCLUSION

Our team found three portfolio mixes that maximized returns at various levels of risk. However, we recommend an optimal mix of 39.9% in Ross Stores, 0% in Pinduoduo, 9.6% in Target Hospitality, 18.5% in Ardmore Shipping Corp, and 32% in Glencore Plc to achieve the objective of minimizing the risk while maximizing the return. This portfolio meets all objectives the Bank

outlined in its RFP and will satisfy its risk tolerance. Our team also recommends re-evaluating the risk between three and six months after the portfolio is in use. At that time, the returns should also be compared with our expectations to ensure the portfolio still aligns with the Bank's goals and risk tolerance level.

APPENDIX

Equation 1.

$$Daily\ Percent\ Return\ = (\frac{Current\ Day\ Rate - Previous\ Day\ Rate}{Previous\ Day\ Rate}) * 100$$

Homework Report Checklist

The team member(s) responsible for checking each item should enter their initials in the field next to each question. All items should be addressed before submitting the assignment with the initialed checklist attached.

Sections & Structure

Overview

ZH	Is the overview concise?
ZH	Does it provide context about the business problem? <Content>
ZH	Does it briefly address your team's work, quantifiable results, and recommendations? <Action>
ZH	Does it offer audience-centered reasons for recommendations? <Context>

Body Sections

ZH	Does the report body include information on methods, analysis, quantifiable results, and recommendations?
ZH	Is content grouped into appropriate sections (*methodology*, *analysis*, *results*, *recommendations*)?

Conclusion

ZH	Does the report have a conclusion?
ZH	Does the conclusion sum up the report and emphasize relevant takeaways?

Structure

ZH	Does each major section have a heading?
ZH	Are sections, subsections, and paragraphs organized logically for easy navigation?

Visuals

Introduction, Discussion, and Captions

ZH	Is each visual introduced in the text before it appears?
ZH	Is each visual close to where it is introduced?
ZH	Does each visual include a title with the following information: type (*table* or *figure*), number, and a descriptive caption?
ZH	Is each visual discussed and interpreted in the text?
ZH	Are figures and tables numbered separately?
ZH	Are table captions above the table? Are figure captions below the figure?

Visual Design

JD	Do figures/tables use audience-friendly labels rather than variable names?
JD	Are the visuals easy to interpret?
JD	Are the visuals appropriately sized?
JD	Do tables appear on one page (*not split between 2 pages*)?
JD	Are legends and axis labels included for figures?
JD	Are numbers in tables right aligned?
JD	Are the visuals designed well (*ex*: *re-created in Word or Excel*, *not blurry or stretched*,…)?

Document Design

Title Page Design

JD	Does it include a descriptive title?
JD	Does it state the team name, team members' names, and the submission date?

Table of Contents Design

JD	Does it list all the major sections of the report with corresponding page numbers?
JD	Do the page numbers and sections in the Table of Contents match the report?

Document Design for Entire Report

JD	Is a standard typeface (*Calibri*, *Arial*, *etc.*) used?
JD	Is the size of the body text between 10-12 pt.?
JD	Are headings and subheadings used to organize information?
JD	Are distinctive text styles (*bold*, *italic*, *etc.*) used to distinguish between heading levels?
JD	Are text styles for headings used consistently (*ex*: *all level-one headings are bold*)?
JD	Are all paragraphs an appropriate length (*fewer than 12 lines*)?
JD	Is white space used to indicate paragraph breaks?
JD	Are bullet lists used for a series of items and numbered lists to show a hierarchy?

Writing Style and Mechanics

Spelling and Capitalization

FM	Are spelling errors located and corrected?
FM	Is spelling consistent throughout (*no switching between acceptable spellings*)?
FM	Is capitalization used appropriately (*proper nouns*, *etc*.)?
FM	Is capitalization of words consistent throughout the report?

Grammar and Punctuation

FM	Are verb tenses used appropriately?
FM	Are marks of punctuation used appropriately?
FM	Is subject-verb agreement used in every sentence?
FM	Is the grammar checker updated and are underlined grammar issues addressed?

Writing Style

FM	Are all sentences in the report easy for your audience to understand quickly?
FM	Are most sentences written in active voice?
FM	Are idioms and vague words eliminated from the report?
FM	Are acronyms introduced before being used?
FM	Are well-written topic sentences included at the beginning of each paragraph?
FM	Are lists parallel?
FM	Is the appropriate point of view used when addressing your audience or describing team actions?