An Interactive Qualifying Project Report:

Submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

By

Didi Dai   _____

Submitted:

February 25, 2018

Approved by Professor Dalin Tang, Project Advisor

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Abstract

This project is a four-week stock simulation research. The goal of the project is for the participant to gain stock trading experience through a real-time simulation so that she can make calculated, well-informed stock investment decisions in the future. This project reviewed the current stock market, analyzed two existing trading techniques, and ran stock simulations on six targeted companies with an investment of $500,000 for each trading method. The results from the simulations indicate that the Technical Trading method is more profitable than the Swing Trading method. This project provided the participant with valuable trading experiences that will be beneficial to future investments.

Acknowledgements

The success of my Interactive Qualifying project (IQP) would not have been possible without the help of many individuals. I would like to start off by thanking Professor Tang for his continuous support and guidance throughout the project. Additionally, I would like to thank my friend, Trevor Valcourt, who helped me collect the simulation data. I would also like to thank my parents for their emotional and financial support. Furthermore, I would like to express my gratitude towards my school, Worcester Polytechnic Institute (WPI) for the logistical support and pacification. The project would not have reached this point if it was not for their countless recommendations and guidance in solidifying my project.

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Chapter 1: Introduction

The goal of this project is to gain some basic understanding of the fundamental principles governing the stock market, to learn how to analyze data and apply some selected trading methods in a stock market simulation to get real trading experience, and to relate current events to stock price trends. To accomplish these goals, I will first review the history of the stock market. I will identify important factors influencing the stock market, and investigate how current events may impact specific stock values. Furthermore, I will analyze techniques for assessing stock prices and values. By reviewing the current techniques and tools people use to trade stocks, I will identify nine companies within the United States to start the stock simulation. The simulation in this project will start with an initial investment of 500,000 dollars in total, and will last four weeks from January 16th to February 16th in 2018. The simulation results will compare the pros and cons of the different trading methods. By the end of this project, I hope to gain some initial experience in stock trading and be able to make well-informed investment decisions.

1.1 Stock Market History

The first stock markets did not appear until the 1500s. However, there were many early examples of markets that are similar to stock markets today. For example, in the 1100s, in order to avoid a high-risk loan, European money lenders started to exchange their loans for a different loan with another. As loan exchanges became more popular, the lenders started to sell debts to the individual investors (Beattie, 2017).

In 1531, the first stock exchange was founded in Antwerp, Belgium where brokers and investors would resolve their debt issues. Still, no real stocks happened at this time,

but many financial partnerships produced profits in a similar way to how the stock market works today.

During the 1600s, the first joint stock companies were founded from doing sea voyage businesses to transfer goods from the east Asia to the western countries. Sea voyage was extremely risky, and the ship owners might lose their profits if their ships were lost. To mitigate the risk, ship owners sought out investors to put up money for the voyage. If the voyage was successful, the investors can receive a return for a certain percentage. Whereas if the voyage was not successful, investors had to bear the risks. Investors were able to spread the risks by investing in several different ventures at the same time (Hur, 2017).

The previous trades were all issues on physical paper, and investors could trade these papers to other investors for profits. However, without the any rules and regulations for issuing the shares, the bubble burst when the companies failed to pay dividends back to investors. In 1773, the first stock exchange with government regulations was launched officially in London. After two decades, the New York Stock Exchange was formed in the United States as well, and quickly became the most important stock exchange in the world (Beattie, 2017).

1.2 Important Factors of Stock Market

The stock market is unstable, and there are many factors that can cause the price of a stock to rise and fall. In general, there are five main factors that affect the stock market: Internal Development, World Events, Inflation and Interest Rates, Exchange Rates, and Hype.

First, internal development of a company is the key factor influencing the stock price. One company's Internal Development can be evaluated by measuring the company's return on investment, change in market value, development of new product, and assessment of business unit managers (Devinney, Yip & Johnson, G, 2010). For example, assessing the employees' education, experience and overall capabilities can help identifying advantages to the company's workforce (Ingram, 2018). The workforce is the company's productive force which generates revenues. Workforce directly affects the company's position at market.

Second, world events such as war, civil anarchy, natural disasters and terrorism are factors influencing the stock market. For instance, in 1955 when President Eisenhower had a heart attack, the market suffered the heaviest dollar loss in history. The value of stocks on the New York Stock Exchange dropped by 14 billion (Niederhoffer, 1971).

Third, inflation and interest rates also influence the stock market. In general, when interest rates are increasing, investors would trade their higher risk stocks for government supported bonds. In this way, they can gain more profits with higher interests rates and as well ensure the investments are safe.

Fourth, currency exchange rates have a direct impact on the stock market. Exchange rates change based on supply and demand of a market. The fluctuation of exchange rates will influence the cost of doing business abroad.

Finally, hype about a company or its new products can also affect the stock market. The positive financial reports, stock market newsletters, internet blogs, and news reports

can create high expectations for the company performances. Investors expecting to gain profits would put money in the stocks based on the hype.

1.3 Stock Market Index

A stock market index measures the value of a group of selected stocks. There are multiple ways to specify stock market indices, such as geographical regions and levels of industrialization. From macro to micro, a global stock market index includes stocks from multiple regions. Some examples of global stock market includes MSCI world, S&P Global 100, and BBC Global 30. A regional market index includes stocks from multiple companies in a region. Some examples are American S&P 500, British FTSE 100, and Japanese Nikkei 225. Having a comprehensive understanding of stock market indices allows investors to compare investment returns and make important financial decisions based on their comparisons (Wikipedia, 2017).

Due to the four-week time limitation, this project will only focus on simulating the stocks in the United States. Within the United States, there are thirteen major stock indices. They are: Amex, Associated Press 60, CBOE, Dow Jones, Goldman Sachs, MarketGrader, MSCI, Nasdaq, Russell Standard & Poor, Value Line Composite, Wilshire Associates, and CPMKTE (Wikipedia, 2018). Each of these stock indices have various divisions concentrated on different industries. This section reviews the five most significant indices in America and their subordinate indices.

1.3.1 Dow Jones Indices (DJI)

Dow Jones Indices includes 11 sub indices. Among all, Dow Jones Industrial Average (DJIA) is the most popular. It tracks the 30 largest and most influential businesses stocks in the United States. DJIA was first published on February 16, 1885,

and now is the most notable of the Dow Average. The DJIA is a price-weighted index, which means higher-priced stocks weigh more than lower-priced stocks. Table 1.1 shows the 30 major companies included in DJIA.

Table 1.1. 30 major companies included in Dow Jones Industrial Average Index

Company	Company	Company	Company
3M	DowDuPont	JPMorgan Chase	Travelers
American Express	ExxonMobil	McDonald's	UnitedHealth Group
Apple	General Electric	Merck	United Technologies
Boeing	Goldman Sachs	Microsoft	Verizon
Caterpillar	The Home Depot	Nike	Visa
Chevron	IBM	Pfizer	Walmart
Cisco Systems	Intel	Procter & Gamble	Walt Disney
Coca-Cola	Johnson & Johnson		

DJIA's current market value is $25,574.73. It increased 26.17% since last year when the value was $20,269.37, and increased 3200% since it was first published when the value was $774.72. The DJIA's market summary is shown in Figure 1.1 below.

Figure 1.1. DJIA Market Summary from 1978 to 2018 from Google Database

1.3.2 Nasdaq Composite Index (NASDAQ)

Nasdaq (NASDAQ) focuses on technology stocks, and includes three sub indices: NASDAQ Composite, NASDAQ-100, and NASDAQ Volatility Index, in which NASDAQ-100 is a subset of NASDAQ Composite. Among all, NASDAQ-100 counts for over 90% of the NASDAQ Composite movement. The companies included in NASDAQ-100 is shown in Table 1.2.

Table 1.2. Companies included in NASDAQ-100

Companies	Companies	Companies	Companies
Activision Blizzard	Cisco Systems, Inc.	Intuitive Surgical Inc.	Regeneron Pharmaceuticals
Adobe Systems Incorporated	Citrix Systems, Inc.	J.B. Hunt Transport Services	Ross Stores Inc.
Alexion Pharmaceuticals	Cognizant Technology Solutions	JD.com	Seagate Technology Holdings
Align Technology, Inc.	Comcast Corporation	KLA-Tencor Corporation	Shire plc
Alphabet Inc. Class A	Costco Wholesale Corporation	Lam Research, Inc.	Sirius XM Radio, Inc.
Alphabet Inc. Class C	CSX Corporation	Liberty Global plc Ordinary A	Skyworks Solutions, Inc.
Amazon.com, Inc.	CTrip International	Liberty Global plc Ordinary C	Starbucks Corporation
American Airlines Group	Dentsply Sirona	Liberty Interactive	Symantec Corporation
Amgen Inc.	Dish Network, Inc.	Liberty Interactive	Synopsys, Inc.
Analog Devices	Dollar Tree, Inc.	Marriott International, Inc.	T-Mobile US
Apple Inc.	eBay Inc.	Maxim Integrated Products	Take-Two Interactive, Inc.
Applied Materials, Inc.	Electronic Arts	MercadoLibre	Tesla, Inc.
ASML Holding	Expedia, Inc.	Microchip Technology	Texas Instruments, Inc.
Autodesk, Inc.	Express Scripts, Inc.	Micron Technology, Inc.	The Kraft Heinz Company
Automatic Data Processing	Facebook, Inc.	Microsoft Corporation	The Priceline Group
Baidu.com, Inc.	Fastenal Company	Mondelēz International	Twenty-First Century Fox Class A
Biogen, Inc	Fiserv, Inc.	Monster Beverage	Twenty-First Century Fox Class B
BioMarin Pharmaceutical	Gilead Sciences, Inc.	Mylan N.V.	Ulta Beauty
Broadcom Limited	Hasbro, Inc.	NetEase, Inc.	Verisk Analytics
CA Technologies	Henry Schein, Inc.	Netflix	Vertex Pharmaceuticals
Cadence Design Systems	Hologic, Inc.	NVIDIA Corporation	Vodafone Group, plc.
Celgene Corporation	IDEXX Laboratories, Inc.	O'Reilly Automotive, Inc.	Walgreens Boots Alliance
Cerner Corporation	Illumina, Inc.	PACCAR Inc.	Western Digital
Charter Communications, Inc.	Incyte Corporation	Paychex, Inc.	Workday, Inc.
Check Point Software	Intel Corporation	PayPal Holdings, Inc.	Wynn Resorts
Cintas Corporation	Intuit, Inc.	QUALCOMM Incorporated	Xilinx, Inc.

In addition, Nasdaq is a market-capitalization-weighted index, which means the companies stocks are weighted by the total dollar value of each shares (Connick, 2017). NASDAQ's current market value is $7,261.06. It increased 34.89% since last year when the value was $5,383.11, and increased 7116% since it was first published in 1978 when the value was $100.63. The NASDAQ's market summary is shown in Figure 1.2 below.

7,261.06 +49.28 (0.68%) ↑
Jan 12, 5:15 PM EST · Disclaimer

| 1 day | 5 days | 1 month | 1 year | 5 years | **Max** |

Figure 1.2. NASDAQ Market Summary from 1978 to 2018 from Google Database

1.3.3 Standard & Poor's 500 Index (S&P 500)

The S&P 500 index represents 505 stocks by 500 companies with a market cap of at least $6.1 billion. The S&P 500 is primarily used as an indicator of the United States' equity and reflects general performance of the large-cap universe. The first index fund, Vanguard 500 Index Fund (VOO), used S&P 500 as its index. Large-cap is a term to describe companies with a market cap of at least $10 billion, which many of the stocks part of the S&P 500 represent. It is largely considered representative of the entire market because it contains a very large portion of the whole market. There are five companies with the most weight: Apple, Alphabet, Microsoft, Amazon, and Facebook.

The S&P 500 has taken over the Dow Jones to become the more preferred index for US stocks. This is because it represents many more companies than the Dow Jones and how each company is weighted. The S&P 500 gives higher weight to larger companies by market cap, versus the DJIA which gives more expensive stocks a higher weighting. One example of the difference here is that one share of Amazon stock is

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approximately $1,300 and one share of Alphabet stock is $1,100. According to the DJIA, Amazon would be weighted more, however, Alphabet's market cap exceeds Amazon by over 100 billion which is considered in the S&P 500 (Investopedia, 2018).

S&P 500's current market value is $2,786.24. It increased 22.37% since last year when the value was $2,276.98, and increased 2999.61% since it was first published in 1978 when the value was $89.89. The S&P 500's market summary is shown in Figure 1.3 below.

Figure 1.3. S&P 500 Market Summary from 1978 to 2018 from Google Database

1.3.4 The Russell 2000 Index (RUT)

The Russell 2000 index simply measures the performance of 2,000 small-cap companies (between $300 million to $2 billion market cap) part of the Russell 3000 index. This index is considered a benchmark for all small-cap stocks in the United States. The average market cap within the Russell 2000 is $1.3 billion. The Russell 2000 is often overshadowed by the DJIA and S&P 500, but it serves as an important indicator of the American economy because it focuses on smaller, domestic businesses (Richard, 2012). Russell 2000's current market value is $1,591.97. It increased 16.43% since last year

when the value was $1,367.28, and increased 27.19% since it was first published in 2016 when the value was $1,2151.64. The Russell 2000's market summary is shown in Figure 1.4 below.
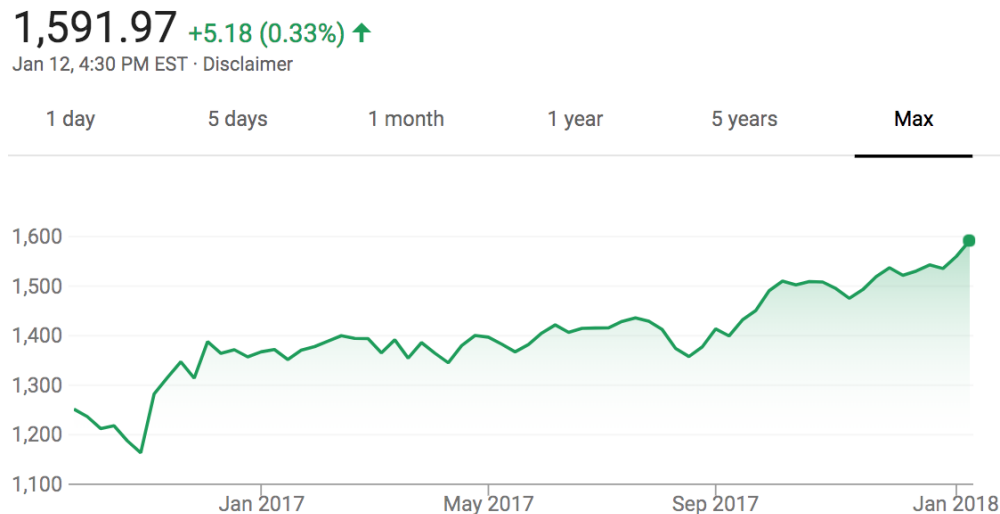
Figure 1.4. Russell 2000 Market Summary from 2016 to 2018 from Google Database

1.3.5 Morgan Stanley Capital International Europe, Australasia, Far East Index (MSCI EAFE)

The MSCI EAFE index represents large and mid-cap securities across 21 markets. These markets are within Europe, Australasia, and the Far East. This index excludes markets within the United States and Canada. This index is used as a benchmark for index-linked financial products (MSCI, 2018). MSCI EAFE's current market value is $2,126.10. It increased 26.79% since last year when the value was $1,676.93, and increased 28.60% since it was first published in 2013 when the value was $1,653.27. The MSCI EAFE's market summary is shown in Figure 1.5 below.
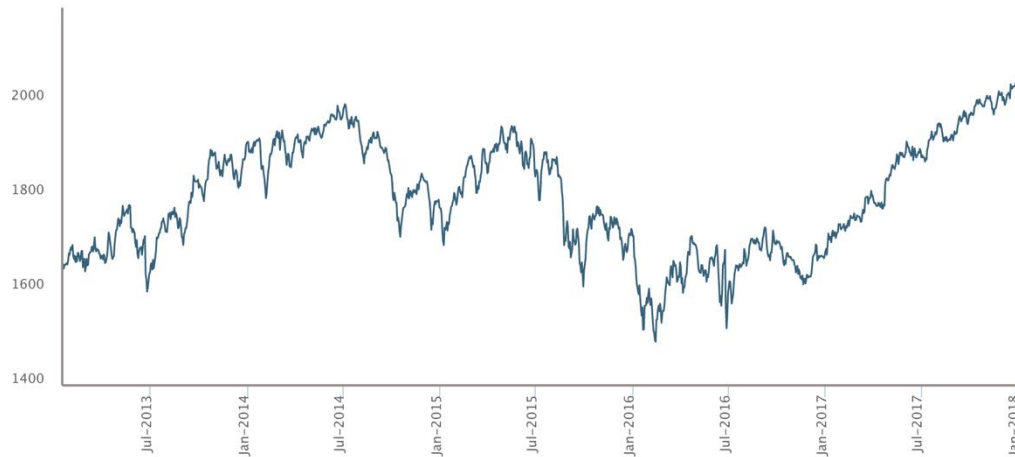
Figure 1.5. MSCI EAFE Market Summary from 2013 to 2018 from Google Database

1.4 Past Researches on Stock Simulation

1.4.1 WPI researches

Within WPI, there are 126 studies in WPI library database. Most of the authors aim to gain personal trading experience through stock simulation in a period time by conducting different trading strategies. In one of the stock simulation projects, five trading strategies were used: day trading, long term trading, diversification, foreign vs. domestic, and spotting trading & forecasting (Brooks, 2016). By performing these five trading methods on a stock simulation for six months with the concentration on four companies, Brooks made a net profit of $146. However, from the results, these investments do not appear very profitable when compared to the conclusions reached by other stock simulation projects.

Another stock simulation project turned a profit of $84,168 in a fourteen-week simulation (He & Wu, Wang, 2016). This project used four different trading methods: technical trading, swing trading, position trading, and simulation trading. Each trading method was used to trade five different stocks. Among all, swing trading was the most profitable.

Comparing the two stock simulation projects, the second one made $84,122 more profit than the first one. The reason is not only because of the longer simulation time, but more importantly the companies they invested in. The first project chose AO Smith Corp (AOS), Baldwin and Lyons Inc (BWINB), Manning & Napier Real Estate Series Class I (MNRIX), and MeetMe Inc (MEET). A huge portion of these companies are related to real estate. The second project picked almost all technology stocks. From these, it's not hard to make a conclusion that in 2016, technology stocks increase higher than real estate stocks.

1.4.2 Non-WPI researches

A contrarian investment strategy was addressed in an academic journal published in 1988. In this journal, the author explains the definition of contrarian stock selection strategy, which consists of buying stocks that have been losers and shorting stocks that have been winners (Chan, 1988). However, by using a simple asset-pricing model, CAPM (Capital Asset Pricing Model), to test this strategy, Chan found contrarian strategy earns a very small abnormal return. The reason for the economically insignificant return is the market overreaction to the news. Winners are overvalued and losers are undervalued. Learning from past research, this project will prevent over evaluating winners, and preclude contrarian investment strategy.

1.5 Stock Market Crashes in History

Stock market crashes occur when a sudden decline of stock prices drop across a large portion of the market. The largest driver of stock market crashes are people panicking over political or foreign events. A crash is often defined as a social phenomenon that combines a negative event or economic factor with crowd behavior. If certain

important participants in the market begin to sell large quantities, other, smaller investors, will follow and drastically bring down the price of the stock. Economic events that often prelude to a market crash can include: prolonged periods of rising stock prices, excessive economic optimism, and P/E ratios exceeding long-term averages (Galbraith, 1929).

One prominent example of a stock market crash is the Wall Street Crash of 1929 in the United States (U.S.), also known as "Black Tuesday." (Americas Library, 2013). The 1920's in the U.S. was considered a technological golden age, with the invention of the radio, automobile, aviation, telephone, and power grid. Companies in these industries were soaring and so did mutual fund companies such as Goldman Sachs as they were reaping in the rewards from their returns. This crash was considered the largest predictor of the Great Depression in the U.S., a severe, worldwide economic depression originating in the U.S (Bone, 2010). Due to the rapid growth of the market, many people believed the market would continue to soar forever. On March 25th, 1929, this was proven false when the Federal Reserve warned Americans of excessive speculation, causing investors to sell at a rapid pace, creating a smaller crash and therefore displaying the weakness in the stock market. On Black Monday (Oct. 28th, 1929), the Dow Jones fell 12.82 percent and another 11.73 percent on the following Black Tuesday, marking the true start to the Wall Street Crash (Wikipedia, 2018).

The aftermath of major stock market crashes such as this has effects on the world economy. Many people blame banks for putting people's deposits at risk on the stock market. In 1930, over 1,300 banks held $853 million in bank deposits. A year later, 2,300 banks went out of business with nearly $1.7 billion in bank deposits, causing over 28,000 business to file bankruptcy in the same year (Brockman, 2008). Psychological effects

were by far the worst part, as business uncertainty affects job security for employees. Naturally, if people are worried about having a job (income), then they are less inclined to spend their money making the economic situation worse because money is not being brought into the economy (Scardino, 1987). There were a few regulations put into place by the Federal Reserve. One rule is known as the uptick rule, and prevents short sellers from driving down the price of a stock further during this time of chaos.

Chapter 2: Methodology

2.1 Stock Simulation Engine

There are many stock trading platforms, such as Etrade, Scottrade, Charles Schwab, TD Ameritrade, Merrill Edge and many others. Each trading platforms has pros and cons: some of these might have lower commission fee, some might have better user interface, and some might have a broader stock selection. However, as a new investor, the stock market is intimidating no matter how excellent the trading platform is. For many newcomers, it is risky to invest their hard earned money. At this point, stock simulation is a good choice for new investors to practice before entering the real stock market. There are many stock simulation programs available in the market, such as Virtual Stock Exchange (VSE) from Market Watch, Wall Street Survivor, How the Market works, Investopedia simulator, and Weseed.

This project will use the Investopedia simulator to perform stock simulation, because Investopedia uses real data from the stock markets. Users can register a virtual account just like using a real brokerage account. The virtual account provides users with an initial virtual cash balance, and users can start to trade. In this project, the initial virtual cash balance is $500,000.

On the simulator's user interface, there are seven tabs located at the top to navigate. Through this navigation bar, users can do stock research, trade stocks, view personal portfolio, track stocks and add them to the watchlist.

To purchase and sell a stock, users can go to the trade tab under the navigation bar, and the system would link to the *Order Stock* screen, shown in Figure 2.1 below. Users can then input the stock symbol (each stock has a unique symbol, and it may not

be the same with company name), choose the transaction type (Buy or Sell), and enter the number of shares. Figure 2.2 shows a preview of the order before it is submitted. In the order details, it shows the price of the stock per share, the quantities to purchase, estimated total price, and the commission fee. In Investopedia simulator, the commission fee is $19.99 per trade for simulating the real online trade since brokerage firms commonly charge commissions for the services of executing trades.

Figure 2.1. Order Stock detail on Investopedia Simulator

Figure 2.2. Preview Order detail on Investopedia Simulator

After trading, the account summary can be found in the portfolio, as shown in Figure 2.3 below. At the top of the stock portfolio, there is a portfolio summary. In this summary, the account value displays the total current value in the account, buying power refers to the available money to spend on future investment in addition to the existed purchases, and annual return indicates the percentage return earned in total. Within the stock portfolio, there is a list of stocks you have purchased and currently hold. This helps to track the trading history and check the total gain or loss per investment.

Account Value (USD) $1,002,803.09   Buying Power$994,234.09   Cash $998,651.09   Annual Return 0.49 %

STOCK PORTFOLIO

Trade Stock   Symbol Lookup   Watchlist   How-To Guide

		SYMBOL	DESCRIPTION	QTY	PURCHASE PRICE	CURRENT PRICE	TOTAL VALUE	TODAY'S CHANGE	TOTAL GAIN/LOSS
+	Sell	WMT	WAL-MART STORES, INC.	100	$70.41	$69.98	$6,998.00	$0.00(0.00 %)	- $43.00(-0.61 %) ↓
+	Sell	PIR	PIER 1 IMPORTS, INC.	100	$6.74	$6.73	$673.00	$0.00(0.00 %)	- $0.50(-0.07 %) ↓
+	Sell	GE	GENERAL ELECTRIC COMPANY	100	$29.73	$29.74	$2,974.00	$0.00(0.00 %)	$1.50(0.05 %) ↑
						Total	$10,645.00	$0.00(0.00 %)	- $42.00 (-0.39 %) ↓

Figure 2.3. Stock Portfolio on Investopedia Simulator

2.2 Investment Strategy

2.2.1 Technical trading

Technical trading is recognizing patterns from past trading data to predict what might happen to stocks in the future. Technical traders would examine stock charts for signs of breakout (Bergen, 2016). By watching lines on stock or index graphs, technical traders can identify buying or selling signals from the signs of convergence or divergence.

Convergence is the movement of future contract price towards spot price of the commodity as the delivery date is close. Customers in general have two ways to purchase a commodity: one way is to buy it outright on a specific day, and another is to purchase a contract that requires delivery of the commodity on a specific day. However, if the future

contract price and the spot price are diverged on the delivery date, there would be an opportunity to gain profits from buying the low-priced commodity and selling the higher priced future contract.

The signs of convergence and divergence can be identified through a trend analysis on Moving Average Convergence Divergence (MACD). MACD is a momentum indicator for analyzing the stock trend. It reflects the moving of future contract price and the spot price. MACD is calculated by subtracting the 26-day exponential moving average (EMA) from the 12-day EMA (Hartle, 1991). This project will be using trend analysis, including using MACD indicator, and pattern analysis to make stock investment decisions. More information about pattern analysis would be explained in Chapter 4.

2.2.2 Swing Trading

Swing traders hold stocks for at least overnight or up to several weeks. The goal of swing trading is to identify a trend, and profit from both the uptrend and downtrend. If the market is bullish, which means the stock trend chart shows an uptrend, swing traders would buy shares, call options and future contracts. Whereas if the market is bearish, which means the overall trend is down, swing traders would short shares and future contracts or buy put options.

This project will perform both bullish swing trade, and bearish swing trade. To correctly operate bullish swing trade, traders need to prevent entering the market at a counter trend. By examining the lowest point ("stop out" point) of the downtrend, traders can limit the losses from exiting the market on time when the stock decreases under the "stop out" point. By finding the highest point of the uptrend, traders can determine a target of profit (Ally, 2017).

To determine when to enter the market to make the maximum profit, this project will calculate the reward-to-risk ratio. If the potential profit is twice as much as the potential loss, the trade is worthwhile. Once the stock hits the target price, traders should consider selling a portion of their stocks to lock in some gains.

There is still an opportunity for swing traders to gain profit, even when there is neither bullish nor bearish indications present. To be specific, swing traders can take a long position near the support area (the lowest point), and take a short position near the resistance area (the highest point).

2.3 Data Analysis Method

Fundamental analysis and technical analysis are two primary methods to analyze data before making an investment decision. Fundamental analysis method focuses on both the quantitative and the qualitative factors of the company, and the industry. This includes the financial statement, income statement, balance sheet and cash flow statement. The technical analysis method concentrates on the statistical analysis of stock price movements based on the existing publicly available information. This project will be using both analysis methods to make investment decisions.

2.3.1 Fundamental Analysis

One essential part of fundamental analysis is the quantitative analysis. Quantitative analysis can help investors gain insight on a company's future investment by reviewing the company's financial data, such as liquidity ratio, profitability ratio, cash flow indicator ratio, and price to earning ratio.

Liquidity ratio can be measured by current ratio, which is current assets divided by current liability. If the ratio is higher than 1.0, the company is well-positioned to cover its

current short-term liabilities. However, the current ratio cannot determine the liquidity situation. It is also important to know how quickly the company can convert their current assets into cash to meet any liabilities.

This project will consider liquidity ratio while making investment decisions. However, this project will concentrate more on profitability ratio to choose stocks. Profitability ratio can be indicated by calculating net profit margin. A number larger than 6% shows a strong business. The formula to calculate Net Profit Margin is shown below:

Net Profit Margin = Net Income / Net Sales (Revenue)

Cash flow indicator ratio can be calculated by using operating cash flow divided by net sales. The greater the amount of operating cash flow, the better their ability to generate consistent improving ratios (Loth, 2018). Since there is not a standard guideline to evaluate cash flow ratio, this project will only slightly consider this ratio as an indicator to the investment decisions.

Price to earnings ratio is the best-known investment valuation indicator. A lower P/E ratio indicates lower risk to investment. In other words, it is worthwhile to invest when the P/E ratio is low. The formula to calculate price to earning ratio is shown below:

P/E = Market Price Per Share / Expected Earning Per Share

Another part of fundamental analysis is the qualitative analysis. Qualitative analysis is based on the intangible aspects of a company, which is hard to quantify. Qualitative analysis of a company involves identifying their business model, competitive advantage, and corporate governance. Having an overview of the company's business model allows investors to have a deeper understanding of how the company makes money. Knowing the unique competitive advantage of the company can help investors to

identify the company's position in the market. An understanding of the company's management and relationships between management and stakeholders is useful to evaluate a company.

Qualitative analysis of the industry will also be conducted in this report to make investment decisions. This method includes analysis of the industry growth, government regulation, market shares, and competition. To analyze the industry growth, it's important to examine whether the number of customers in the overall market will grow. If investors knew any regulation limitation to certain industries then wrong investment decisions could be prevented. Likewise, to research the market share of a stock can help to determine if the company is bigger than their rivals. By knowing the environment, investors can make a wiser investment decision.

2.3.2 Technical analysis

Technical analysis is the study of historical chart patterns and trends of stocks. It can be applied to make investment decisions and to compare trading results. To perform technical analysis on stocks, investors discover the stock's movement by using bars and charts. This project will analyze the stock movement of the selected companies in 5 years, and match the overall trend lines with the existed mathematical distributions. By doing so, I can make a rough prediction of the future stock movements.

2.3.3 Data Analysis to Compare Trading Results

To analyze the data generated after trading is one way to learn the stock market. As George Santayana said, "Those who cannot learn from history are doomed to repeat it." This report will have an analysis and comparison chapter at the end to summarize the trading results. This section introduces how to perform data analysis to compare trading

results. There are three golden rules to apply to the trading results (The World Bank, 2008):

1. Benchmark all indicators against meaningful comparators.

2. Whenever possible, show graphs and relegate detailed tables to appendices.

3. Put each graph's message in plain English—if a graph suggests no comment, it is probably unnecessary.

Following these three rules, this project will compare the trading results from the simulation to identify the most effective way to profit from trading stocks. The trading processes will be documented through the report, and detailed tables will be attached to appendices. Within each chapter, there will be a section comparing the results and displaying the chapter conclusion. This project will organize the trading history of each selected company in a graph to make horizontal and vertical comparisons. Horizontal comparisons refer to the contrast of the individual stock price fluctuation during the simulation period. Vertical comparison designates the difference among all the selected companies stock price changes during the same period.

Chapter 3: Technical Trading

This chapter will record the process of trading stocks by using technical trading strategy. First, this chapter introduces three selected companies, and the reason why they were chosen for investment. Second, this chapter will present the initial investment record, and the MACD chart for each company in the next four weeks. The transaction data will be documented at the end of each week's report. Finally, this chapter will analyze and display the results of the total gain or loss after the four-week simulation.

3.1 Company Selected

To make this stock simulation more diversified, I chose three stocks from three different industries: technology, health care, and consumer directory.

3.1.1 Amazon (AMZN)

Amazon was founded by Jeff Bezos on July 5th, 1994 in Seattle, Washington. Evolving from an online bookstore, Amazon has diversified its businesses nowadays, and now offers online merchandising video, audiobooks, electronics, food, furniture, clothes, toys, jewelry, and more. Amazon also manufactures consumer electronics such as Kindle e-readers, Fire tablets, Fire TV, and Echo. Amazon also provides the world's largest cloud infrastructure services.

According to the financial data provided by Market Watch, Amazon had a total revenue of $135.99 billion in 2016, and an income of $47.72 billion. The Net Profit Margin is 35%, which is 26% higher than the average U.S. public company industry Net Profit Margin.

In addition, on November 22nd, 2017, Amazon's stock price was $996.3 per share. Three months later, the price increased 32% to $1,315.24 on January 22nd, 2018. The

three months' MACD chart is shown below in Figure 3.1. The gap between the 12 month's EMA and 26 month's EMA indicates an opportunity to gain profit. As a result, Amazon was selected to invest in this project.

Figure 3.1 Amazon MACD Chart from Market Memory.com

3.1.2 Abbvie (ABBV)

Abbvie, a research based pharmaceutical manufacturing company, was founded in 2013 as a branch of Abbott Laboratories. Since 2014, Abbvie started to acquire small pharmaceutical companies to develop and commercialize therapies for cancers. Abbvie's three major mergers and acquisitions are with ImmuVen, Pharmacyclics, Stemcentrx.

The forecasted P/E growth rate is 15.87 in 2018, which is lower than the 18.67 P/E rate in 2017, indicating a lower risk in investment. According to the 2016 annual financial report provided by Abbvie, Abbvie has a total revenue of $5.855 billion in 2016, and meanwhile has an income of $25,638 billion. The net profit margin is 22.84%, which is 16.84% higher than the average U.S. public company industry net profit margin.

In addition, on January 20th, 2017, Abbvie's stock price was $61.15 per share. Whereas, a year later, the price increased 74% to $106.49 on January 22nd, 2018. The three months' MACD chart is shown below in Figure 3.2. The gap between the 12 month's EMA and 26 month's EMA indicates an opportunity to gain profit. As a result, Abbvie was selected to invest in this project.

Figure 3.2 Abbvie MACD Chart from Market Memory.com

3.1.3 Starbucks (SBUX)

Starbucks was founded in 1971 in Seattle, Washington by Baldwin, Siegl, and Bowker. As the most successful American chain coffee company, Starbucks has over 23,768 chain stores worldwide. Starbucks' main products are coffees, teas, fresh juices, sandwiches, and snacks, including some seasonal products to the locality of the store. Starbucks brand coffee drinks are also sold at grocery stores.

Starbucks net income was $2.885 billion in 2017 while its revenue was $22.39 billion. The net profit margin was 12.3%, which is 6.3% higher than the average U.S.

public company industry net profit margin. In addition, on January 20th, 2017, Starbuck's stock price was $57.66 per share. One year later, the price increased 6.56% to $61.44 on January 22nd, 2018. The three months' MACD chart is shown below in Figure 3.3. The gap between the 12 month's EMA and 26 month's EMA indicates an opportunity to gain profit. As a result, Starbucks was selected to invest in this project.

Figure 3.3 Starbucks MACD Chart from Market Memory.com

3.2 Simulation

The initial investment I put in for these three companies are roughly equal to $38,790. The total value of investment on each stock varied depending on the pattern of past stock trend and MACD indicator. Table 3.1 below shows the first trade of in the simulator. Each trade costed $4.99 in commission fees.

Table 3.1 Initial investment on stocks by using technical trading method

Date	Symbol	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
							$500,000.00	
1/17/2018	AMZN	Buy	$1298.45	30	$38,958.49	0	$461,041.51	0
1/17/2018	ABBV	Buy	$103.25	372	$38,413.99	0	$422,627.52	0
1/17/2018	SBUX	Buy	$61.20	635	$38,864.45	0	$383,763.07	0

3.2.1 Week One

Over the first week, the total profile for the investment on Amazon, Abbvie, and Starbucks rose by $2,724.29 in total. However, the Starbucks only rose 0.82%, which is much lower compared to the rise of the other two stocks. Amazon rose 3.90%, and Abbie rose 2.29%. By comparing the percent increase, I want to sell Starbucks stock and purchase more Amazon stock to have more investment return. But it is too early to make this decision, I need more information to increase my confidence to make the investment.

According to Starbucks MACD chart from 17th to 23rd in January 2018, shown in figure 3.4 below, there is still a chance to gain profit, because of the gap between the EMAs. However, the gap is small compared to the other two companies MACD charts.
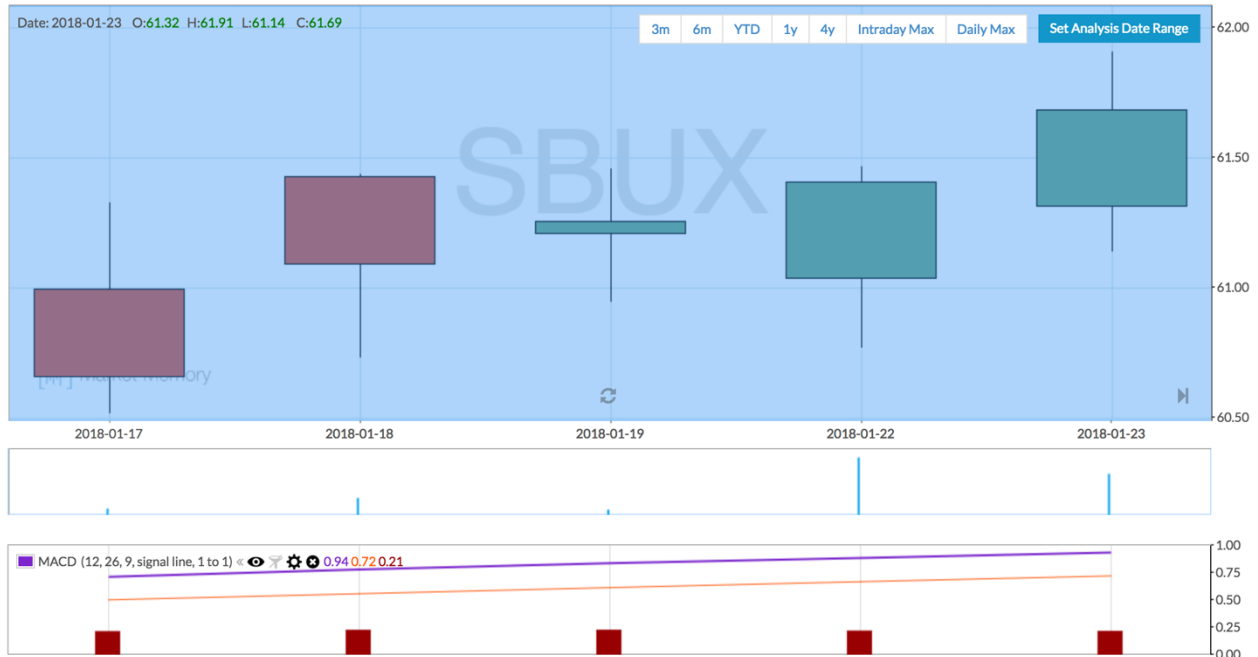
Figure 3.4 Starbucks' MACD Chart from 17th to 23rd January 2018

Amazon's MACD is 8.56, which is the value of the 12-day EMA (36.74) subtracted by the 26-day EMA (28.18). Starbucks' MACD is only 0.22, which is the value of the 12-day EMA (0.78) subtracted by the 26-day EMA (0.56). The figure 3.5 shows the gap of spot price and the future contract price, which indicate an opportunity to gain profits. The differences of gaps between figure 3.4 and figure 3.5 may not be obvious, due to the differing scales. However, the numbers display the distinction.

Figure 3.5 Amazon's MACD Chart from 17th to 23rd January 2018

Abbvie's MACD, which is 0.39, shown in figure 3.6 also shows a better opportunity to make a profit than Starbucks. However, Amazon's MACD is bigger than Abbvie's MACD, which means Abbvie stock is not as profitable as Amazon stock.

Figure 3.6 Abbvie's MACD Chart from 17th to 23rd January 2018

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The research above proves my initial proposition. I decided to sell 500 shares of Starbucks stock, and reinvest that money on 23 shares of Amazon stock. However, I don't want to sell all my Starbucks' stock shares, because there is still some chance to profit - just not as much as on Amazon shares. I will hold the rest of Starbucks' stock and continue to monitor it.

Table 3.2 Week one report of my profile by using technical trading method

Date	Symbol	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
1/23/18	AMZN	Buy	$1,349.28	23	$31,033.44	$0.00	$352,729.63	$0.00
1/23/18	SBUX	Sell	$61.68	500	$30,840.00	$240.00	$383,569.63	$240.00

3.2.2 Week Two

Until January 30 in 2018, the second week of this simulation started, the investment on Amazon stocks had the highest total gain, which is $5,562.58, among all the selected companies. The fact that it gains the most profits proves it was a good decision to purchase more Amazon stocks last week. However, Starbucks stock price dropped last week, and caused a total of $544.87 loss. This again shows that I made a good decision last week when I sold 500 shares of Starbucks stock. Additionally, Abbvie has the second largest gain, which is $5213.58. It was a good decision to hold onto Abbvie's stock.

According to the weekly MACD chart, shown in Figure 3.7, for Amazon from January 23rd to 30th in 2018, there is still a large gap between the 12 weeks EMA and 26 weeks EMA. The 9-day EMA value is 8.39. This means there is still an opportunity to gain profits from Amazon stocks. I choose to hold my Amazon stocks for this week.

Date: 2018-01-30 O:1403.17 H:1439.25 L:1392.00 C:1437.82

| 3m | 6m | YTD | 1y | 4y | Intraday Max | Daily Max | Set Analysis Date Range |

MACD (12, 26, 9, signal line, 1 to 1) « 👁 ⚙ ✕ 59.21 47.51 11.70

Figure 3.7 Amazon's MACD Chart from 23rd to 30th January 2018

However, the MACD chart (Figure 3.8) for Starbucks is a disaster this week. Both the 26-week EMA line and 12-week EMA lines decreased. The 26-week EMA line dropped below the 12-week EMA line, which accounts to a negative value for 9-week EMA signal. A negative 0.36 MACD value attributes to a loss in Starbucks investment. I want to prevent a further loss on my account, so I decide to sell my Starbucks stocks.

Date: 2018-01-31 O:57.23 H:57.45 L:56.70 C:56.81
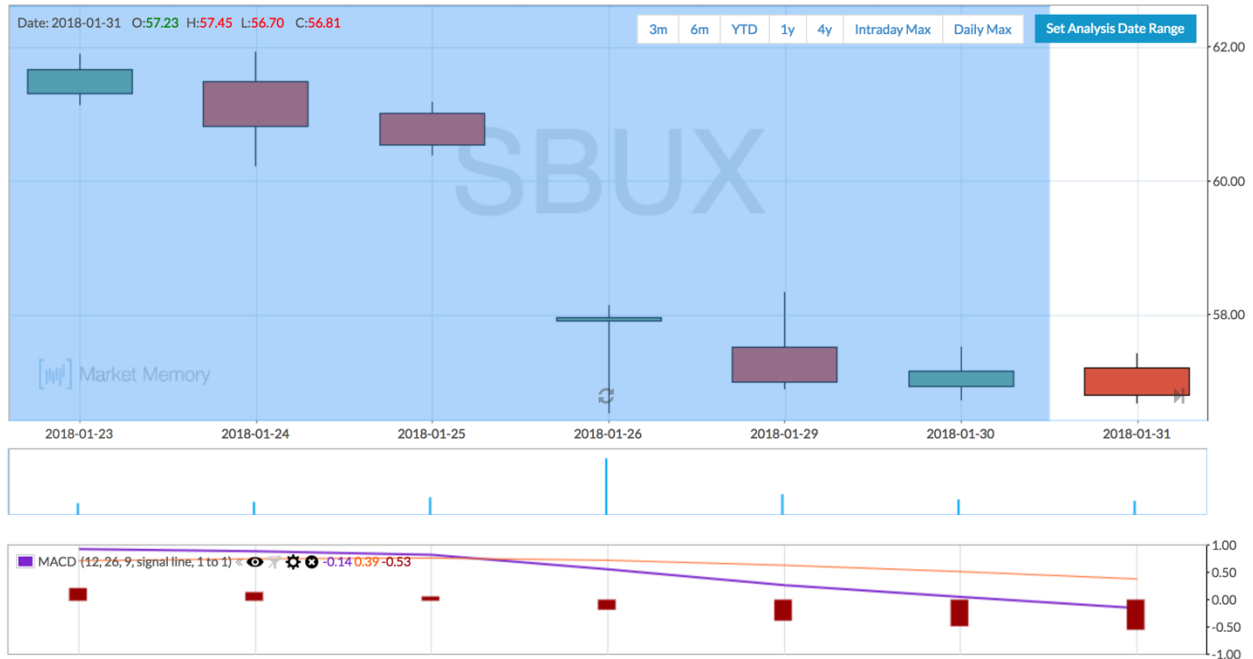
Figure 3.8 Starbucks' MACD Chart from 23rd to 30th January 2018

Abbvie's MACD chart (figure 3.9) displays room for investors to gain profits. Even though the current gap between 12-week EMA and 26-week EMA on Abbvie's MACD chart is smaller than the gap shown on Amazon's MACD chart, the gap on Abbie's MACD chart is growing bigger. Due to the positive dynamic change of Abbvie's MACD chart, I foresee an opportunity to make profit. I decided to buy in more Abbie's stock this week.

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Figure 3.9 Abbvie's MACD Chart from 23rd to 30th January 2018

Table 3.3 is the transaction summary of this week. I sold 100 shares of Starbucks stock, and reinvested that money on 50 shares of Abbvie stock. However, I don't want to sell all my Starbucks' stock shares, because there is still a chance to profit. I will hold the rest of Starbucks' stock and continue to monitor it.

Table 3.3 Week two report of my profile by using technical trading method

Date	Symbol	Buy /Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
1/31/18	ABBV	Buy	$115.38	$50.00	$5,769.00	$0	$377,800.63	$0
1/31/18	SBUX	Sell	$56.15	$100.00	$5,615.00	($505.00)	$383,415.63	($265.00)

3.2.3 Week Three

Until February 6th in 2018, the total profit of the investment on Amazon's stock dropped from $629.11 to $4,933.47. Meanwhile, Abbvie's stock profit also decreased a lot from $5,213.58 to $1,700. Starbucks' stock price dropped even more, compared to the

other two stocks. The Starbucks' stock investment resulted a $919.36 total loss on my profile.

According to the weekly MACD chart, shown in figure 3.10, for Amazon from 30th January to 6th February in 2018, the gap between the 12 weeks EMA and 26 weeks EMA is shrinking, and almost crosses by 6th February. The 9-day EMA value is only 0.62. This means there is very little opportunity to gain profits from Amazon stocks. I chose to sell all of my Amazon stocks to lock in the gains.

Figure 3.10 Amazon's MACD Chart from 30th to 6th February 2018

Same with Amazon, Abbvie's MACD chart (figure 3.11) displays very little room for investors to profit. The gap between 12-week EMA and 26-week EMA on Abbvie's MACD chart is shrinking. Soon, these two EMA lines will meet and cross each other. Since there is little chance to profit this week, I decided to sell Abbie's stock on February 6th.
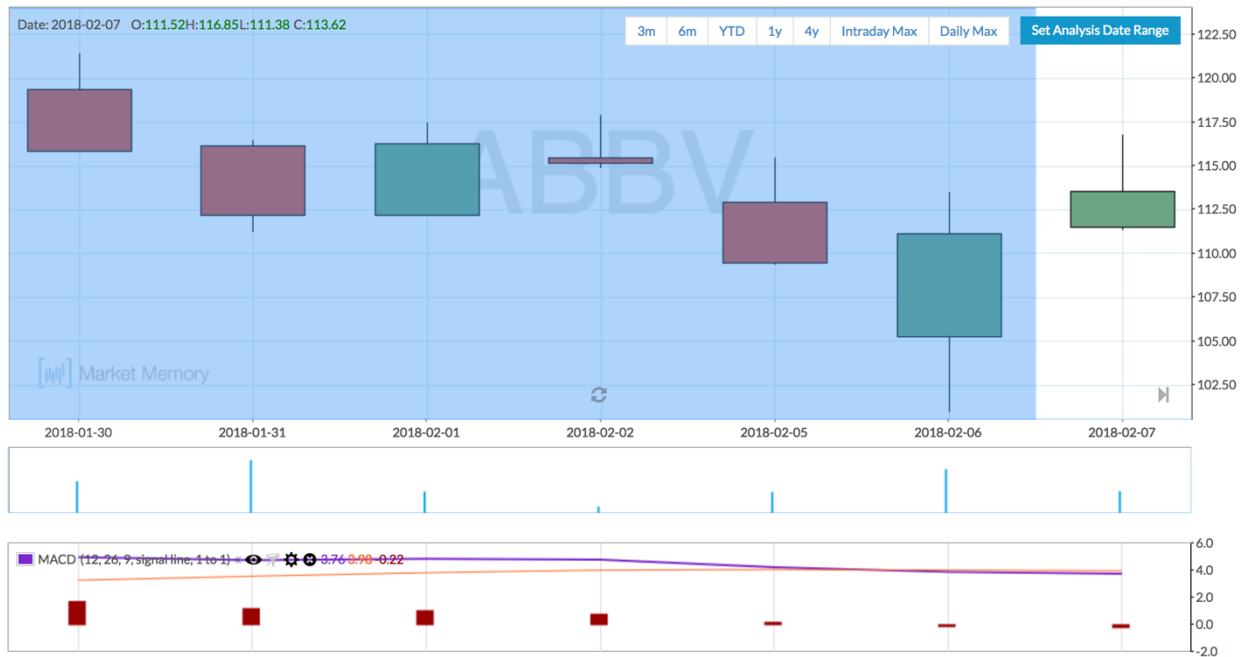
Figure 3.11 Abbvie's MACD Chart from 30th to 6th February 2018

The MACD chart (figure 3.12) for Starbucks is even worse this week. Same as last week, both the 26-week EMA line and 12-week EMA lines decreased. Moreover, the 26-week EMA line dropped below the 12-week EMA line, which accounts to a negative value for 9-week EMA signal. A negative 0.63 MACD value attributes to further loss in Starbucks investment. I want to prevent a further loss on my account, so I decided to sell my Starbucks shares.
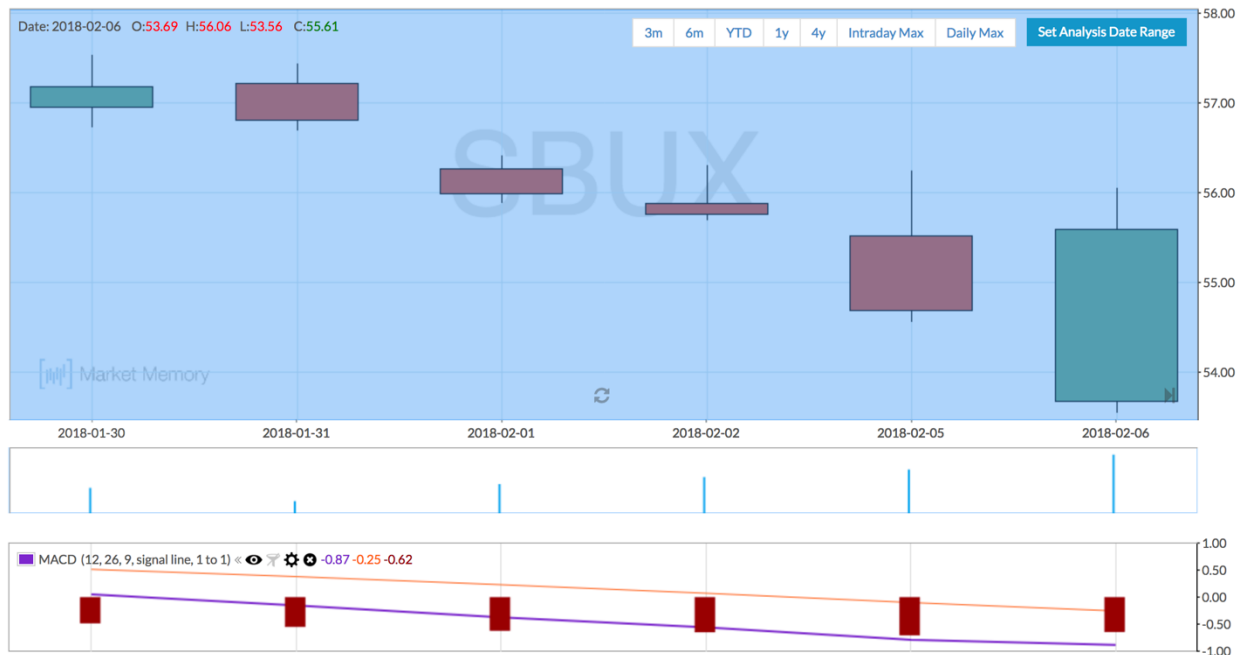
Figure 3.12 Starbucks' MACD Chart from 30th to 6th February 2018

Table 3.4 is the transaction summary of this week. I sold all of the shares I was currently holding, which included 53 shares of Amazon, 422 shares of Abbvie, and 35 shares of Starbucks.

Table 3.4 Week three report of my profile by using technical trading method

Date	Symbol	Buy /Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
2/6/18	AMZN	Sell	$1,428.16	53	$75,692.48	$5,705.54	$459,108.11	$5,440.54
2/6/18	ABBV	Sell	$111.99	422	$47,259.78	$3,081.78	$506,367.89	$8,522.32
2/6/18	SBUX	Sell	$55.50	35	$1,942.50	($199.50)	$508,310.39	$8,322.82

3.2.4 Week Four

There is no record for total gain and total loss during the last few days because I sold all my stock shares on 6th February. The stock market experienced a "financial crisis" last week, and many technology stock prices dropped dramatically. This week, the stock

market is slowly recovering. The stock prices are rising again. I decided to reinvest my money into the stock market.

According to the Amazon weekly MACD chart, shown in Figure 3.13, the gap between the 12-week EMA and 26-week EMA are growing larger than from 6th February to 12th February in 2018. However, the 12-week EMA is laying below the 26-week EMA, which results in the 9-day EMA value being -11.49. The negative MACD shows a high risk to invest money into Amazon stock. However, it is also a good chance to profit because the gap is already so big. The chances the gap would shrink is likely. I decided to purchase 30 shares of Amazon stock on 12th February. I will buy in more along with the change in the stock price to average down my buy price.

Figure 3.13 Amazon's MACD Chart from 6th to 12th February 2018

AbbVie's MACD chart is shown in Figure 3.14 below. It indicates a low risk to invest in AbbVie stock. The gap between the 12-week EMA and 26-week EMA is conversely growing. On 6th February, the MACD value reached its lowest point of -0.67. Again, I

foresee a good opportunity to gain profit from purchasing the stock at a low price. Considering the low risk, I decided to buy in 300 shares of Abbvie's stock on February 12th.

Figure 3.14 Abbvie's MACD Chart from 6th to 12th February 2018

Starbucks' MACD chart is shown in Figure 3.15 below. The 26-week EMA line is still below 12-week EMA line, which results in the 9-week EMA being -0.42. However, the negative MACD value this week is greater than last week's MACD value, which is -0.63. The risk to invest in Starbucks stock is lower than the risk last week. I decided to buy 300 shares of Starbucks stock this week.
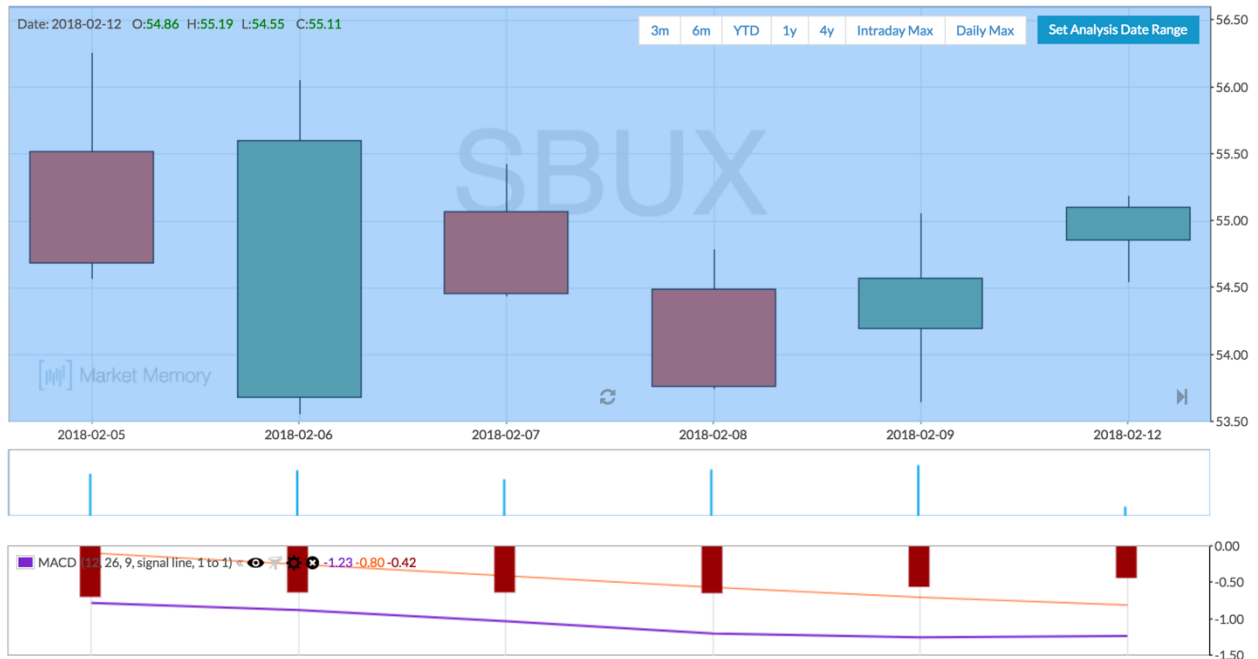
Figure 3.15 Starbucks' MACD Chart from 6th to 12th February 2018

Table 3.5 is the transaction summary on 12th February. I bought in 30 shares of Amazon stock at a price of $1,383.98, 300 shares of AbbVie stock at a price of $112.26, and 300 shares of Starbucks stock at a price of $55.68 on 12th February. On the last day of the fourth week, I sold all my stocks, and gained $12,518.32 total profit.

Table 3.5 Week four report of my profile by using technical trading method

Date	Symbol	Buy /Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
2/12/18	AMZN	Buy	$1,383.98	30	$41,519.40	$0	$466,790.99	$0
2/12/18	ABBV	Buy	$112.26	300	$33,678.00	$0	$433,112.99	$0
2/12/18	SBUX	Buy	$55.68	300	$16,704.00	$0	$416,408.99	$0
2/16/18	AMZN	Sell	$1,453.43	30	$43,602.90	$2,083.50	$460,011.89	$10,406.32
2/16/18	ABBV	Sell	$118.38	300	$35,514.00	$1,836.00	$495,525.89	$12,242.32
2/16/18	SBUX	Sell	$56.60	300	$16,980.00	$276.00	$512,505.89	$12,518.32

3.3 Results

After performing a four-week stock simulation by using the technical trading method, I earned $12,518.32 profit on my $500,000 investment. Figure 3.16 shows the total cash on my profile from the beginning of the investment to the fourth week of the simulation. The total cash on my account was low in first two weeks, because I bought in stock shares by using cash. After I sold my stock shares gradually, I cashed out my stocks. On the last day of the simulation period, I sold all my stocks, and now have $512,505.89 on hand. The difference between the amount of profit and the amount of total cash increased is due to the $4.99 commission fee per trade.
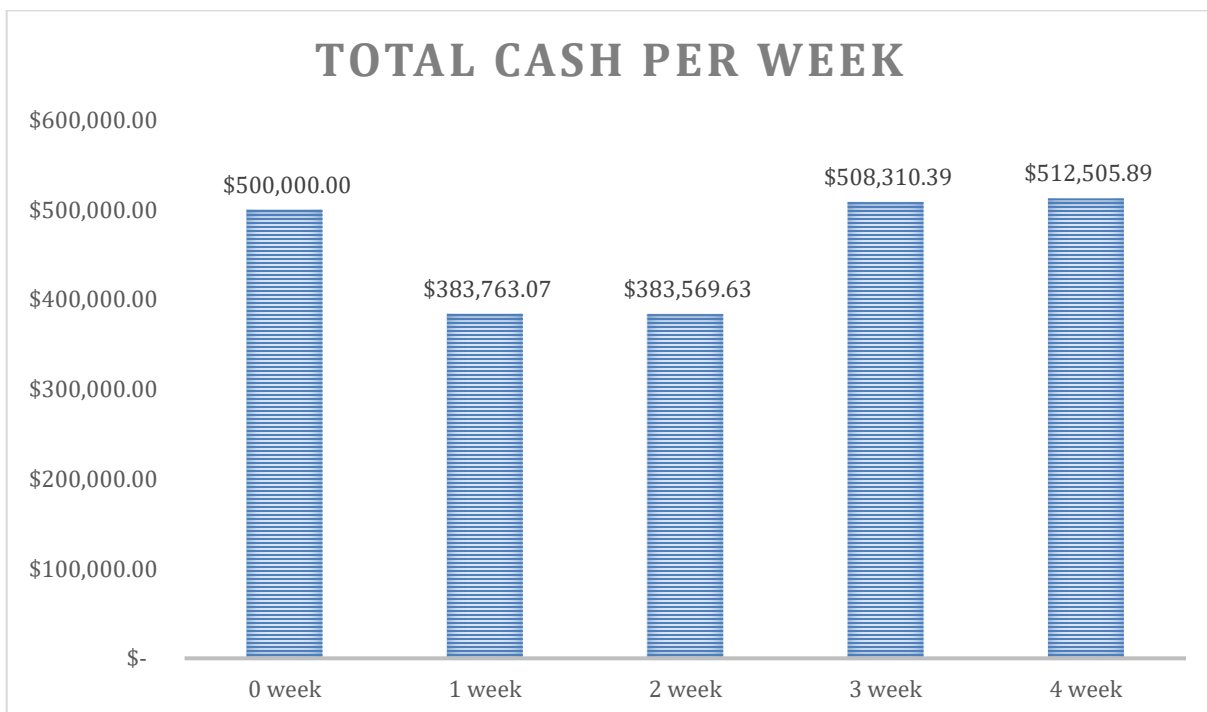
Figure 3.16 Total Cash per week by using Technical Trading method

During the four-week simulation period, the shape of the stock trend of three companies combined is shown in Figure 3.17 below. The general stock trend of these three companies was an uptrend in the first two weeks, but a downtrend on the third week.

By analyzing the MACD chart of these three companies, I successfully predicated the possibility of losing money on the third week. I sold a big portion of the stock shares on hand, and locked in some profits. I also predicted that the stock price of these three companies would go up again, so I bought in the stocks at the beginning of the fourth week, and profited.
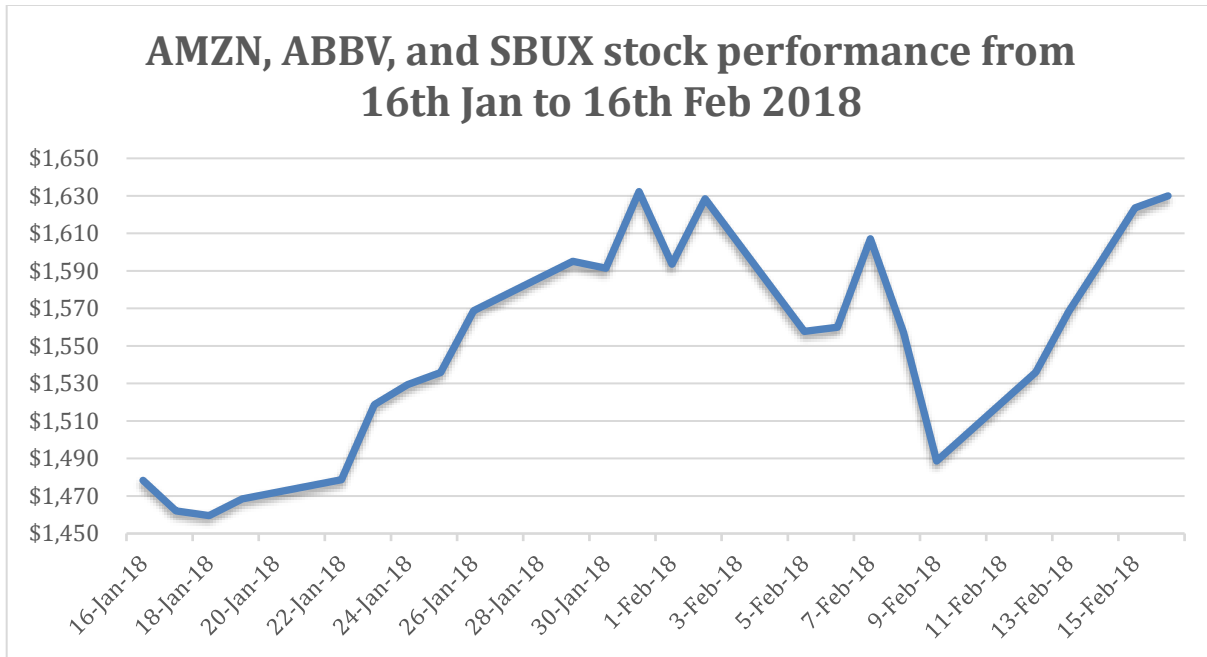
Figure 3.17 AMZN, ABBV, SBUX stock performance

Figure 3.18 shows the profit generated per week by using Technical Trading method. On week one, the total profit was $240. On week two, the total loss was $265, which was caused by selling 100 shares of Starbucks stocks at a price of $56.15. The selling price was $5.05 lower than the purchasing price. However, this loss does not affect the total profit on the last two weeks. On week three, the total profit was $22,285.68, because I sold my stocks before the price went down. On week four, I bought in the stocks again before the price went up, and sold the stocks at a high price. By doing so, I gained

$35,166.96 profit on the fourth week. The profit per week chart matches a polynomial distribution, with an equation: Y=3358.6X^2-4054.9X-707.13.

PROFIT PER WEEK

$y = 3346.6x^2 - 3999.7x - 743.13$

	1 week	2 week	3 week	4 week
	$240.00	-$265.00	$22,285.68	$35,166.96
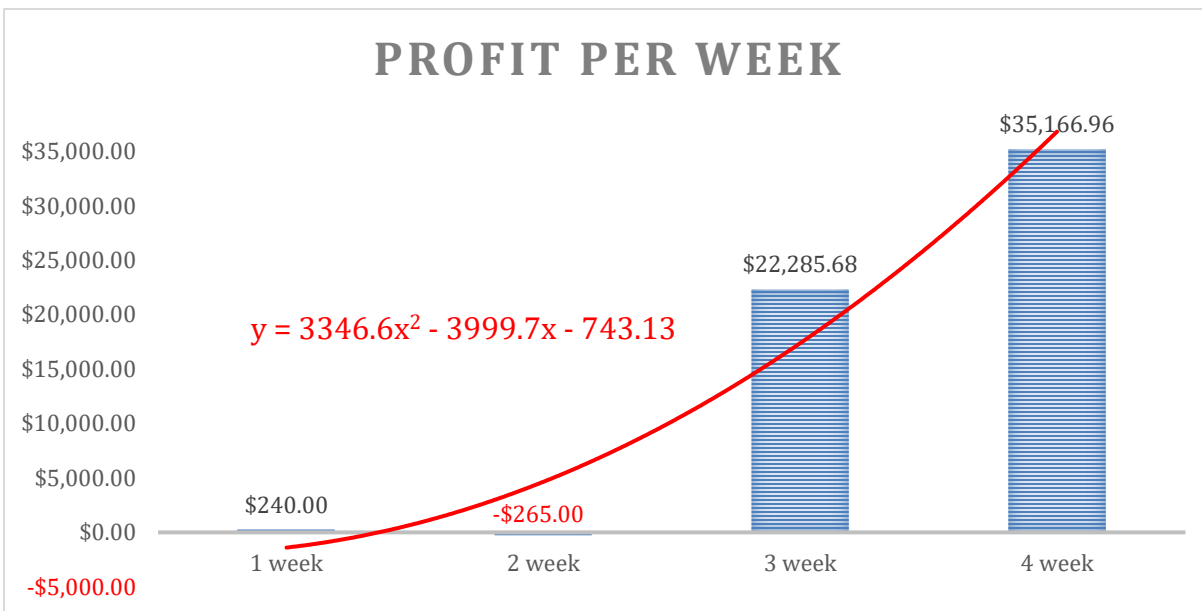
Figure 3.18 Profit per week by using Technical Trading method

Chapter 4: Swing Trading

This chapter records the process of trading stocks by using swing trading. First, this chapter introduces three selected companies, and the reason why they are chosen for investment. Second, this chapter will present the initial investment record, and analysis of stock trends in each company in the next four weeks. Like chapter three's structure, the transaction data will be documented at the end of each week's report. Finally, this chapter will analyze and display the results of the total gain or loss after the four-week simulation.

4.1 Company Selected

To diversify this simulation and make it comparable with the companies selected during the technical trading simulation, I chose three similar stocks from the technology, health care, and consumer directory industries.

4.1.1 Google (GOOGL)

Google was founded by Larry Page and Sergey Brin in 1998. Its initial public offering was in 2004, and since then Google stock has always been on the rise. Google is specialized in internet-related services and products, such as Google search engine, YouTube, cloud storage, map and navigation, and many others. Google also manufactures Google Pixel phone, Google Home and Google Chrome tablets.

On 30th September 2017, Google reported its latest quarter financial statement, in which the revenue was $27,772 million, income after tax was $6,732 million, and gross profit of $16,624 million. It is not hard to calculate the net profit margin, which is 24.2%. The net profit margin is much higher than the average U.S. company's net profit margin.

Google's P/E ratio is 26.68, which is significantly lower than the other tech companies' P/E ratio. These numbers indicate that Google is a highly profitable company.

From 2004, when Google's IPO took place, to 23rd January 2018, its stock price continuously increased 212.12%. The shape of its stock trend, shown in Figure 4.1, fits well with the exponential distribution function: $Y=256.92*e^{0.3723x}$.

Market summary > Alphabet Inc Class A
NASDAQ: GOOGL - Jan 23, 4:22 PM EST

1,176.17 USD ↑12.01 (1.03%)
After-hours: 1,170.62 ↓0.47%

| 1 day | 5 day | 1 month | 3 month | 1 year | 5 year | max |

$$Y=265.92e^{0.3723x}$$

Figure 4.1 Google stock trend in 5 years

4.2.2 Regeneron Pharmaceuticals, Inc (REGN)

Regeneron Pharmaceuticals, founded in 1988, is a biotechnology company headquartered in Tarrytown, New York. It focuses on neurotrophic factors research, and produces multiple pharmaceutical products, such as Arcalyst, Eylea, Zaltrap, and Praluent.

Regarding the financial report of REGN, it has an estimated P/E ratio of 26.6 in 2018, and a net profit margin of 25.88%. These numbers demonstrate good performance

by REGN. From the 5 years stock trend diagram, shown in figure 4.2, I can draw a polynomial distribution line to track the pattern. The formula for the polynomial distribution is $Y = 4.1595X^3 - 75.322X^2 + 396.56X - 112.95$. The stock price per share has increased 118% since 2013.

Market summary > Regeneron Pharmaceuticals Inc
NASDAQ: REGN - Jan 23, 4:37 PM EST

381.71 USD ↑5.85 (1.56%)
After-hours: 381.64 ↓0.02%

| 1 day | 5 day | 1 month | 3 month | 1 year | 5 year | max |

$$y = 4.1595x^3 - 75.322x^2 + 396.56x - 112.95$$

Figure 4.2 Regeneron Pharmaceuticals stock trend in 5 years

4.3.3 Netflix (NFLX)

Netflix was founded by Reed Hasting and Marc Randolph in 1997. Netflix is specialized in steaming videos, and DVD sales and rental. It also produces film and television, in which the most famous one is House of Cards. Meanwhile, Netflix also manufacturers Netflix buttons for remote controls, allowing users to instant access Netflix on their devices.

Netflix's' P/E ratio is 97.82, which is higher than Google and Regeneron Pharmaceuticals. Its net profit margin is 4.04% in 2017, which is lower than the average

U.S. companies net profit margin. Investing Netflix stock would be considered risky. However, Netflix stock price per share increased 31.77% in a month from December 2017 to January 2018. As shown in figure 4.3, Netflix stock trend line fits well in an uptrend exponential distribution model with an equation Y=33.721*e^0.2075x. It is now in a bullish market, and it has the possibility to continuously increase in the next few weeks.

Figure 4.3 Netflix stock trend in 5 years

4.2 Simulation

The initial investment I put in for these three companies is roughly equal to $38,790 each. This number was calculated by taking the average of the total initial money I have, which is $500,000, on the total number of 12 companies I planned to invest. The total value of investment on each stock are various depending on the company's net profit margin and its historical trends. Table 4.1 below shows the first trade of in the simulator. Each of the trade cost $4.99 commission fee.

Table 4.1 Initial investment on stocks by using Swing trading method

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
							$500,000.00	
1/16/18	GOOGL	Buy	$1,140.31	10	$11,403.10	$0	$488,596.90	$0
1/18/18	GOOGL	Buy	$1,124.90	24	$26,997.60	$0	$461,599.30	$0
1/17/18	REGN	Buy	$373.65	103	$38,485.95	$0	$423,113.35	$0
1/17/18	NFLX	Buy	$218.98	173	$37,883.54	$0	$385,229.81	$0

4.2.1 Week One

Over the first week, the total profile for the investment on Google, Regeneron Pharmaceuticals, and Netflix rose by $2,404.04. However, Regeneron Pharmaceuticals shares dropped 0.1%, which caused $39.14 total loss. Compared to Regeneron Pharmaceuticals, both Google and Netflix rose considerably.

As seen in Figure 4.4., Google showed a rising trend. The highest point of the uptrend is $1,179.50 which appeared at the end of the day on January 23rd. The lowest point of the downtrend is at 2:30 PM on January 23rd with a value of $1,165.96. If we buy the stock at a price of $1172.67, then the risk to reward ratio is 0.98. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The equation to calculate the risk to reward ratio is shown below:

$$(\$1172.67 - \$1165.96) / (\$1179.50 - \$1172.67) = 0.98$$

The ratio is less then 1.0, which indicates the profit potential is greater than the risk potential. With this information, I decided to buy in more Google Stock.

Figure 4.4 Google stock trend during the first week simulation

Regeneron Pharmaceuticals' stock also shows an increasing trend (figure 4.5) in the bullish market. The highest point of the uptrend is $381.58 which appeared at 10:30 AM on January 23rd. The lowest point of the downtrend is at 2:00 PM on January 19th with a value of $373.07. If we buy the stock at a price lower than $377.325, then the risk to reward ratio is lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. I set the unknown trading price to X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$373.07) / (\$381.58 - X) < 1.0$$

However, during the whole week, the stock price doesn't fall into the expected range that the profit potential is larger than the risk potential. With this information, I decided to hold REGN stock.

Figure 4.5 REGN stock trend during the first week simulation

According to figure 4.6, Netflix's stock had a slight increase from January 17th to 22nd. Then it has a drastic boost on January 23rd. It remained steady for the rest of the day on the 23rd. The highest point of the uptrend is $257.71 which appeared at 10:00 AM on January 23rd. The lowest point of the downtrend is at 2:00 PM on January 22nd with the value of $226.05. If we buy the stock at a price lower than $241.88, then the risk to reward ratio is lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. I set the unknown trading price to X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$226.05) / (\$257.71 - X) < 1.0$$

However, during this week, the stock price never went below $241.88. The peak was reached on January 23rd, when there was a drastic boost. With this information, I decided to take a short position near the resistance area, where the trend peak is. In other words, I am going to sell part of Netflix stock shares to lock in my gains.

Figure 4.6 NFLX stock trend during the first week simulation

Table 4.2 below is a summary of week one transactions. I sold 100 shares of Netflix to lock in the $3,132 total gain. Then I bought in 21 more shares of Google at the price of $1,172.67 per share. No transactions for REGN this week.

Table 4.2 Week one transaction by using Swing trading method

Date	Symbol	Buy /Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
1/23/18	GOOGL	Buy	$1,172.67	21	$24,626.07	$0	$360,603.74	$0
1/23/18	NFLX	Sell	$249.31	100	$24,931	$3,033.00	$385,534.74	$3,033.00

4.2.2 Week Two

Over the second week, the total profile for the investment on Google, Regeneron Pharmaceuticals, and Netflix goes up $7,282.80 in total, which is $4,878.76 more than the first week's total gain. However, the percentage increase per company is different.

Google's total gain increased 2.99%, REGN's total gain increased 2.30% and Netflix's total gain rose 28.25%. Although all three companies have positive increase in total gains, Netflix has the largest increase. If I didn't sell Netflix stock last week, I would have more profit this week. I realized I played too conservative last week, so this week I am going to be more aggressive.

During the second week simulation, Google's stock fluctuated widely. The highest point of the uptrend is $1,198.00 which appeared at 10:00 AM on January 29th. The lowest point of the downtrend is at 3:00 PM on January 31st with the value of $1,174.55. If we buy the stock at a price lower than $1186.275, then the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The unknown trading price is X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$1174.55) / \$1198.00 - X) < 1.0$$

Since the current stock price is lower than $1,186.275, I decided to buy 20 more shares of Google stocks.

Figure 4.7 Google stock trend during the Second week simulation

Regeneron Pharmaceuticals' stock shows a decreasing trend (figure 4.8) this week. I sense it is an opportunity to test bearish swing trading. Same with the bullish swing trading technique, I need to first identify the highest point of the uptrend and the lowest point of the downtrend. According to figure 4.8, the highest point of the uptrend is $384.85 which appeared at 2:00 PM on January 29th. The lowest point of the downtrend is at 3:30 PM on January 26th with the value of $371.91. If I buy the stock at a price lower than $378.38, then the risk to reward ratio is lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. I set the unknown trading price to X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$371.91) / (\$384.85 - X) < 1.0$$

Because the current market price of REGN is much lower than $378.38, I decided to buy REGN stock.

Figure 4.8 REGN stock trend during the second week simulation

According to figure 4.9, Netflix's stock trend follows a polynomial distribution during the second week simulation. The graph shows an increasing trend from January 23rd to January 29th, and a decreasing trend from January 29th to 31st. The peak of this graph is at 2:00 PM on the 29th, with a value of $286.81 per share. The lowest point of the downtrend is at the end of the day on January 31st with a value of $269.58. If we buy the stock at a price lower than $278.195, then the risk to reward ratio is lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. I set the unknown trading price to X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$269.58) / (\$286.81 - X) < 1.0$$

The current market price of Netflix is lower than $278.195, so I decided to buy 50 shares.

Figure 4.9 NFLX stock trend during the second week simulation

Table 4.3 below is a summary of week two transactions. I bought in 20 shares of Google, 50 shares of REGN, and 50 shares of Netflix.

Table 4.3 Week two transaction by using Swing trading method

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
1/31/18	REGN	Buy	$366.65	50	$18,332.50	$0	$367,202.24	$0
1/31/18	GOOGL	Buy	$1,182.22	20	$23,644.40	$0	$343,557.84	$0
1/31/18	NFLX	Buy	$270.30	50	$13,515.00	$0	$330,042.84	$0

4.2.3 Week Three

Over the third week, the total profile for the investment on Google, Regeneron Pharmaceuticals, and Netflix went down $14,172.80. At this point, the total profit is -$6890. Interestingly, the pattern of these three companies stock trends is quite opposite to their patterns in the previous two weeks. Google's total profit went down 6.12%, REGN's total gain improved 8.90%, and Netflix's total gain surprisingly rose 11.85%.

Google's stock dropped drastically. The highest point of the uptrend is $1,084.43 which appeared at the end of the day on 6th February. The lowest point of the downtrend is at 9:30 AM on the same day with the value of $1,033.00. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The unknown trading price is X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$1033.00) / (\$1084.43 - X) < 1.0$$

The calculated result of X is $1,058.715. However, the stock price is $1,084.43 now, so I decided to hold my shares of Google stocks, and buy in if any opportunity arises.

Figure 4.10 Google stock trend during the third week simulation

Regeneron Pharmaceuticals' stock shows a decreasing trend this week. However, there's a slight upward movement by the end of day on 6th February. According to figure 4.11, the highest point of the uptrend is $347.01 which appeared at 12:30 PM on 2nd February. The lowest point of the downtrend is at 12:00PM on 6th February with a value of $319.67. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$319.67) / (\$347.01 - X) < 1.0$$

The result of X is $333.34. Because the current market price of REGN is higher at $378.38, I decided to hold REGN stock for this week.

Figure 4.11 REGN stock trend during the third week simulation

According to figure 4.12, Netflix's stock showed a downtrend at the first three days in February and then an uptrend since the third day to 6th February. The peak of this uptrend is at 11:30 AM on 2nd February, with a value of $270.38 per share. The lowest point of the downtrend is at 9:30 AM on February 5th with a value of $261.91. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$261.91) / (\$270.38 - X) < 1.0$$

The result of X is $266.645. Since the current market price of Netflix is lower than $266.645, I decided to buy Netflix shares.

Figure 4.12 NFLX stock trend during the third week simulation

The reason why Google and Regeneron Pharmaceuticals stock price decreased dramatically is because of the new government tariff policy. By this week, most companies had published its end of quarter earnings. However, most of the technology companies had an earning missing estimate, because they paid off 15.5% in taxes to move the cash off-shore back to U.S. Plus, the United States government is lowering the corporate tax rate to a flat rate of 21% from 35% for the companies with taxed income over $10 million. Most companies chose to pay off a certain tax rate to move their assets back to U.S for the better tax policy.

As a result, the dramatic drop of the stock price is just temporary. The big technology companies' stock prices which seems to drop a lot are doing fine. From the bigger picture, the economy is still robust. Table 4.4 below is a summary of week three transactions. I bought in 100 shares of Netflix.

Table 4.4 Week three transaction by using Swing trading method

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
2/6/18	NFLX	Buy	$265.72	100	$26,572.00	$0	$303,470.84	$0

4.2.4 Week Four

Over the fourth week, the profit for the investment on Google, Regeneron Pharmaceuticals, and Netflix rose $9,579.69. Google's total profit went down 8.59%, REGN also went down 7.64%, and Netflix raised 1.29%.

During the fourth week, Google's stock dropped drastically. The highest point of the uptrend is $1,065.24 which appeared at 12:00 PM on 12th February. The lowest point of the downtrend is at 1:30 PM on 9th February with a value of $1,004.12. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of the uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The unknown trading price is X. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$1004.12) / (\$1086.25 - X) < 1.0$$

The calculated result of X is $1,045.185. The stock price is $1,056.65 now, which is slightly higher than $1045.185. However, comparing to the stock price two weeks ago, $1056.65 is a low price, so I decided to buy 10 more shares of Google stock.

Figure 4.13 Google stock trend during the fourth week simulation

Regeneron Pharmaceuticals' stock performance during the past week is recorded in Figure 4.14 below. The highest point of the uptrend is $348.00 which appeared at 10:00AM on 8th February. The lowest point of the downtrend is at 11:30AM on 9th February with a value of $317.29. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of the uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$317.29) / (\$348.00 - X) < 1.0$$

The result of X is $332.645. Because the current market price of REGN is $343.43, which is only slightly higher than $332.645, I decided to buy in 10 more shares of REGN stock for this week.

Figure 4.14 REGN stock trend during the fourth week simulation

According to Figure 4.15, the peak of the uptrend on Netflix shares is at 11:30 AM on 7th February, with a value of $271.38 per share. The lowest point of the downtrend is at the end of the day on 12:30 AM February 9th with a value of $238.44. Assuming we buy the stock at a price lower than $X, the risk to reward ratio would be lower than 1.0. To calculate the risk reward ratio, I set the highest point of the uptrend as a target of profit, and the lowest point of the downtrend as the stop out point. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$238.44) / (\$271.38 - X) < 1.0$$

The result of X is $227.91. Since the current market price of Netflix is $255.33, which is much lower than $266.645, I decided to hold Netflix stock.

Figure 4.15 NFLX stock trend during the fourth week simulation

Table 4.8 below is a summary of week four transactions. I bought in 10 shares of Google at the price of $1056.65, and 10 shares of REGN at the price of $343.43 on 12th February. On the last day of the fourth week, I sold all my stocks, and lost $84.31 in total.

Table 4.5 Week four transaction by using Swing trading method

Date	Symbol	Buy /Sell	Price	Shares	Net Cost/ Proceeds	Profit/ Loss	Total Cash	Total Profit
2/12/18	GOOGL	Buy	$1,056.65	10	$10,566.50	$0	$292,904.34	$0
2/12/18	REGN	Buy	$343.43	10	$3,434.30	$0	$289,470.04	$0
2/16/18	GOOGL	Sell	$1,106.95	85	$94,090.75	($3,146.92)	$383,560.79	($113.92)
2/16/18	REGN	Sell	$332.75	163	$54,238.25	($6,014.50)	$437,799.04	($6,128.42)
2/16/18	NFLX	Sell	$278.55	223	$62,116.65	$6,044.11	$499,915.69	($84.31)

4.3 Results

After performing four-week stock simulation by using the swing trading method, I lost $84.31 on my $500,000 investment. Figure 4.16 shows the total cash on my profile from the beginning of the investment to the fourth week of the simulation. The total cash on my account was low in first three weeks, because I kept buying in stock shares by using cash. After I sold my stock shares all at once on the last week, I cashed out my stocks, and now I have $499,915.69 on hand. The difference between the amount of money lost and the amount of total cash decreased is due to the $4.99 commission fee per trade.
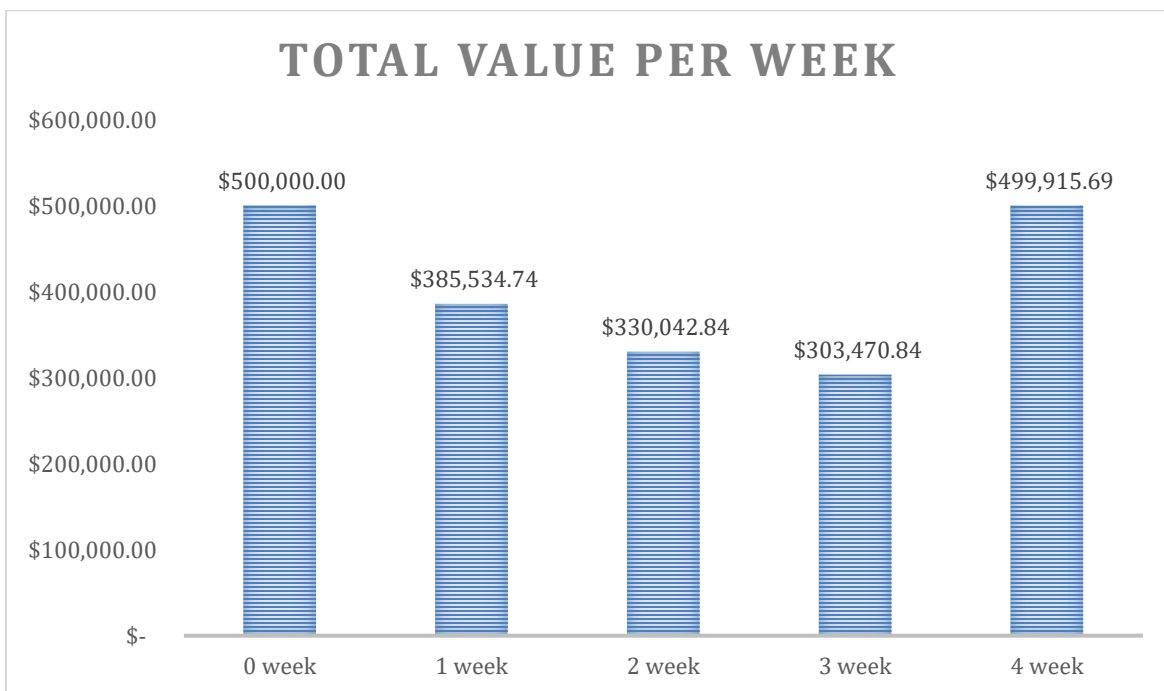

Figure 4.16 Total Cash per week by using Swing Trading method

During the four-week simulation period, the shape of the stock trend of three companies combined is shown in Figure 4.17 below. The general stock trend of these three companies was an uptrend in the first week, but a downtrend on the second and third week.
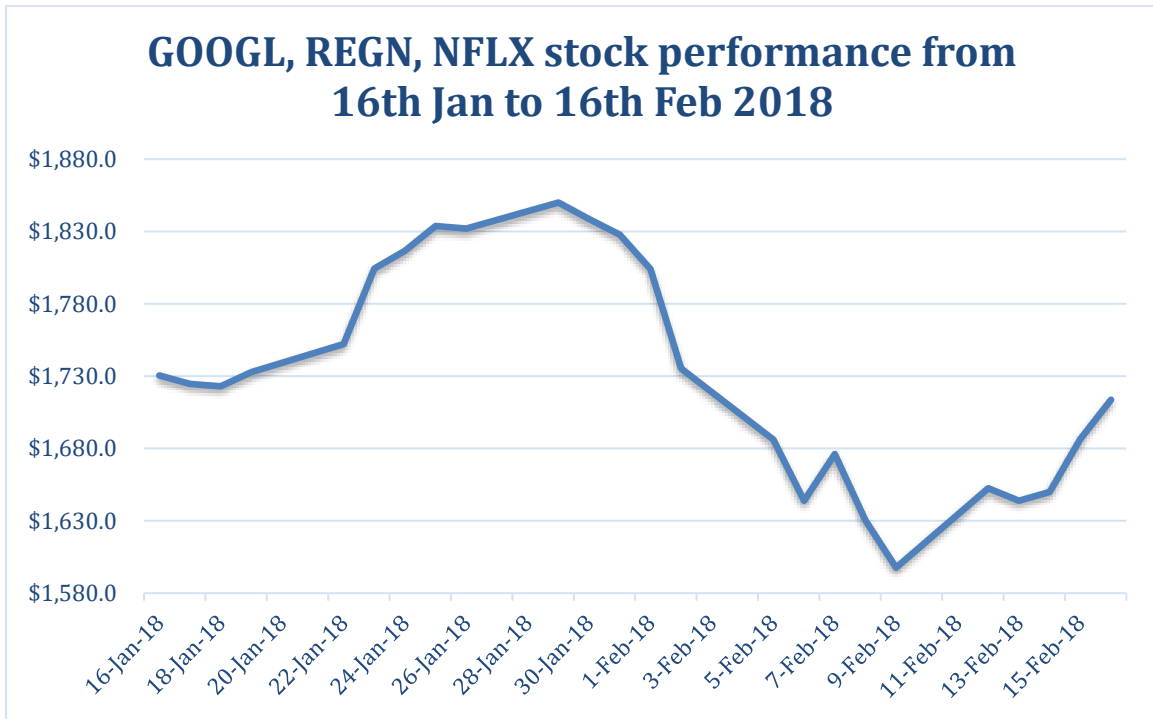
Figure 4.17 GOOGL, REGN, NFLX stock performance

Figure 4.18 shows the profit generated per week by using the swing trading method. On week one, the total profit was $3033.00. Whereas, on week two and week three, the total profits were zero, because I did not sell any stocks. Instead I bought in more GOOGL, and REGN stock shares. The stock market experienced an economic crisis, and I did not foresee this disaster. To minimize my total loss, I bought in more stocks at a low price at the beginning of week four. On the last day of the simulation period, I sold the stocks at a relatively high price. By doing so, I only lost $84.31 on the fourth week. The profit per week chart below matches a linear distribution, with an equation: Y = -935.19X + 3075.2.

PROFIT PER WEEK

$3,300.00
$2,800.00
$2,300.00
$1,800.00
$1,300.00
$800.00
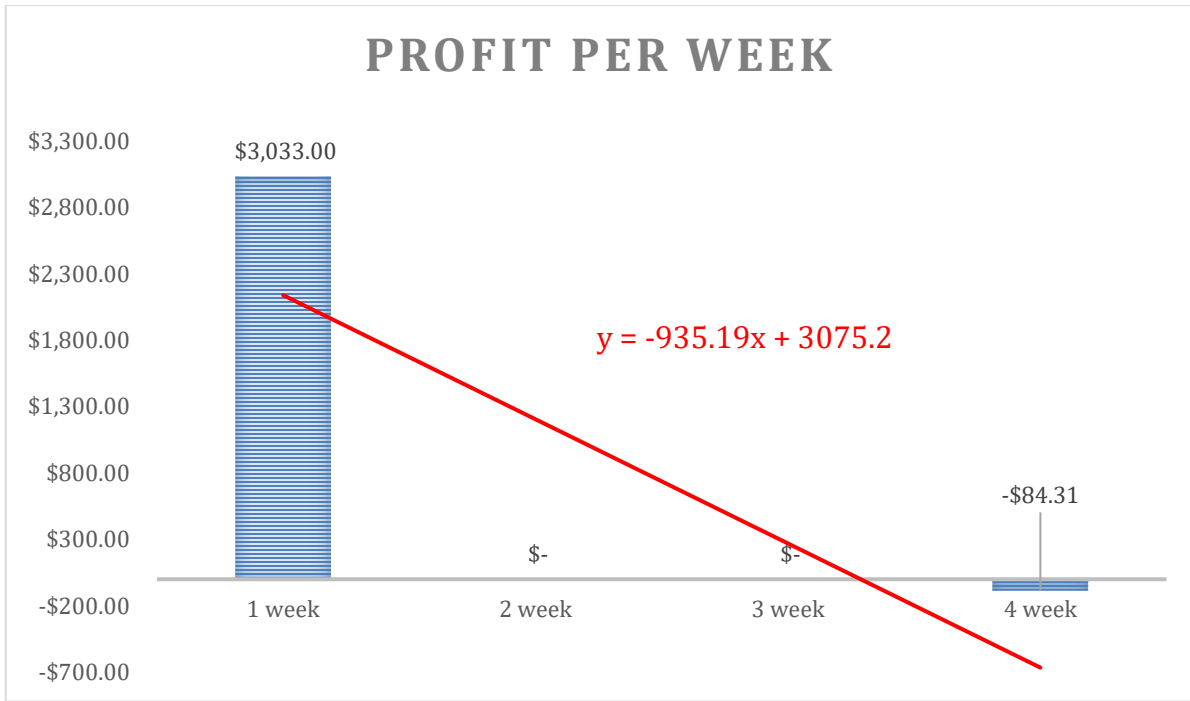$300.00
-$200.00
-$700.00

$3,033.00

$-

$-

-$84.31

$y = -935.19x + 3075.2$

1 week 2 week 3 week 4 week

Figure 4.18 Profit per week by using Swing Trading method

Chapter 5: Analysis and Comparison

I tested two trading strategies in this four-week simulation: technical trading strategy, and swing trading strategy. Technical trading had been successful and gained significant profits while swing trading was a failure. Their end balances were $512,505.89, and $499,915.69 respectively. This resulted in a return on investment of 3.0% for Technical Trading, and - 0.02% for Swing Trading. The return from technical trading is very significant for such a short period of time. Comparatively, swing trading is not as effective as technical trading.

The trading results are realistic and fair to analyze and compare because my stock portfolio is diversified. In detail, the three companies I invested, by using each trading strategy, fall into three different industry sectors. Two companies with similar company size, P/E ratio, and stock price per share in the same industry area were each assigned to the two trading strategies. In total, three pairs of companies were selected. Three of them are assigned to technical trading method and the other three are to swing trading.

Figure 5.1 presents the weekly profit differences between these two trading methods. According to the chart, technical trading has a steady increase on it's weekly profits. The trend line for technical trading matches with a polynomial distribution with an equation:

$$Y = 3346.6X^2 - 3999.7X - 743.13$$

However, the swing trading strategy is relatively pessimistic. The profit's general trend line is going down, and it matches a linear distribution with an equation:
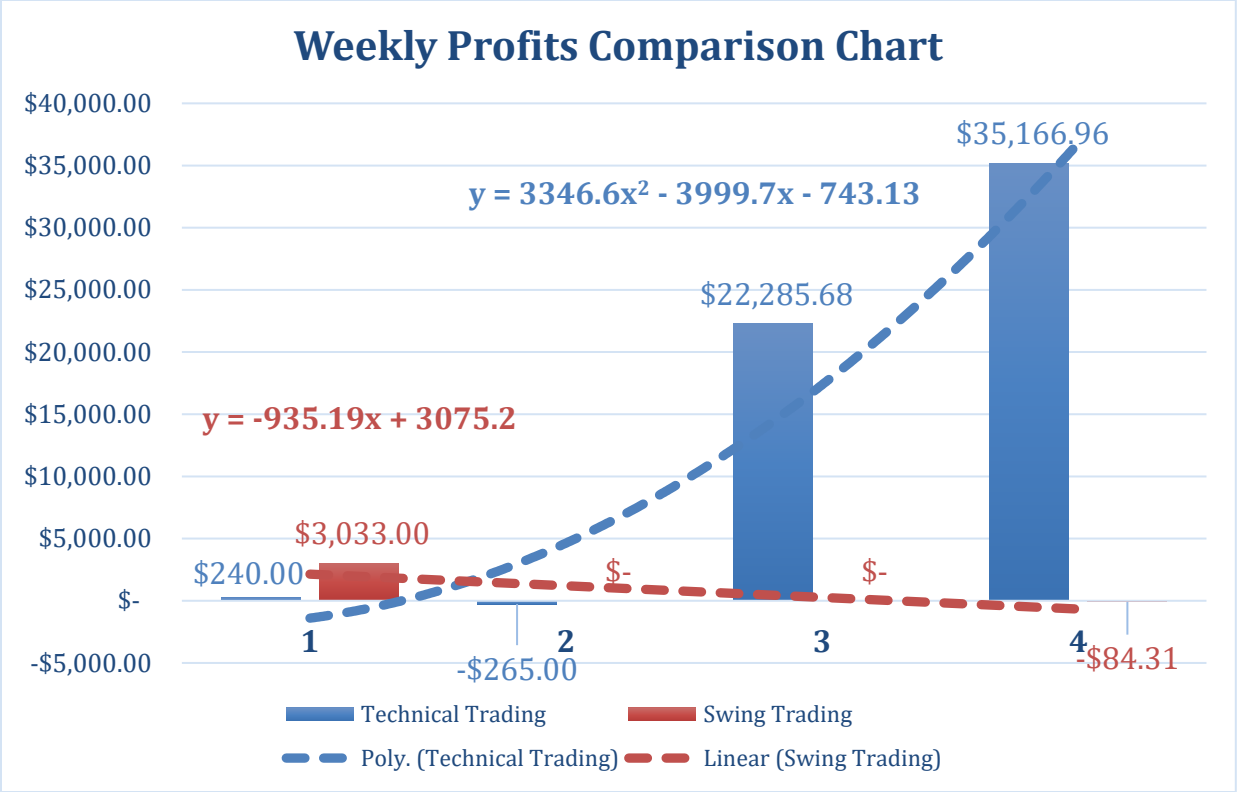
$$Y = -935.19X + 3075.2$$

Weekly Profits Comparison Chart

$y = 3346.6x^2 - 3999.7x - 743.13$

$y = -935.19x + 3075.2$

Figure 5.1 Weekly Profits Comparison Chart for Two Trading Methods

Regarding the weekly total cash, the comparison chart of technical trading method and swing trading method (Figure 5.2) did not show much difference. Both trend lines match to binomial distributions. The binomial distribution function for technical trading is Y= 46,481X^2 − 287,112X + 753,833. The function for swing trading is Y = 26,129X^2 − 141,815X + 595,662. However, the first coefficient of swing trading's distribution function is larger than that of technical trading's function. This means swing trading may have a great growth in the next two weeks. But just to compare the total cash changes of theses two trading methods in this four-week simulation, the total cash on technical trading profile is far more considerable than swing trading.
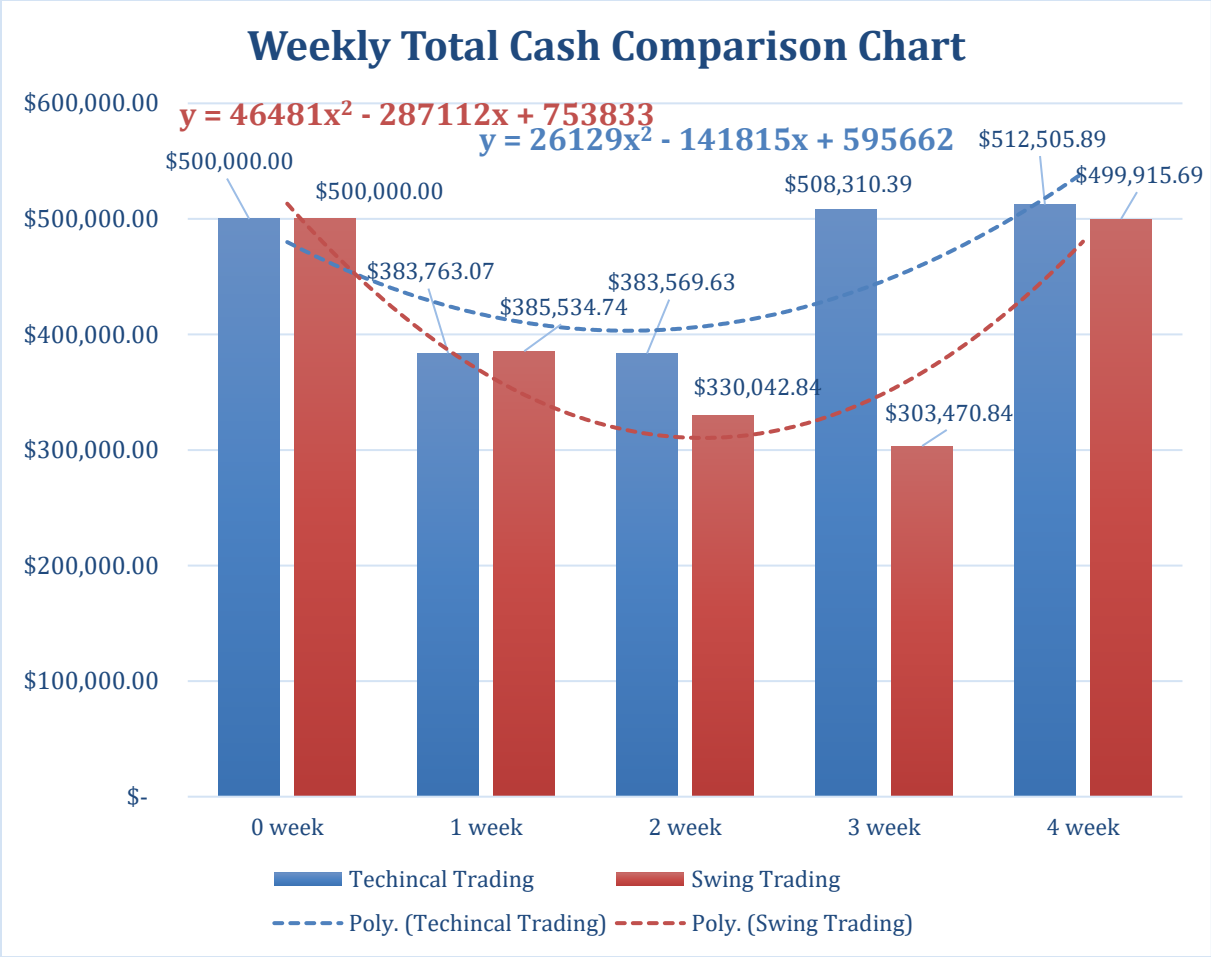
Figure 5.2 Weekly Total Cash Comparison Chart for Two Trading Methods

After performing a vertical analysis on the two trading methods, I will perform a horizontal comparison on each company chosen for investment. Figure 5.3 shows the profit and loss analysis of each company during the stock simulation period. The chart is arranged in descending order from the highest profit to the highest loss. Benchmarking the profit and loss of the companies enables me to control and improve my investments. According to Figure 5.3, the company with highest profit is Starbucks with a total profit of $20,816.14. The company with highest loss is Regeneron Pharmaceuticals Inc with a total loss of $6,128.42.

Figure 5.3 Profit and Loss Analysis of each Company

Chapter 6: Conclusion

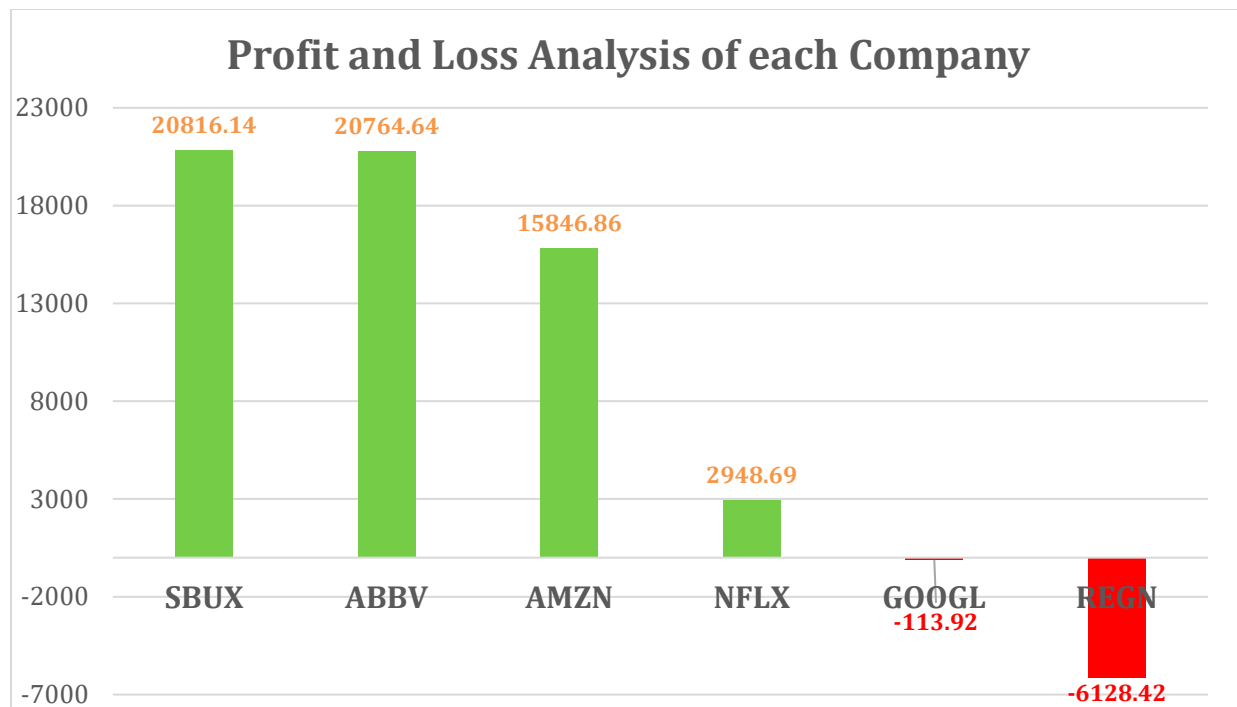From the results, the technical trading strategy is the most effective technique out of the two methods that were chosen. However, given more time, I think that the swing trading would have balanced out with technical trading because I only had a few months to simulate the stock market. Overall, I am satisfied with the results of trades, because I not only gained a considerable amount of profit by using two trading methods, but also fulfilled my goals of doing this project.

First, I aimed to gain some basic understanding of the fundamental principles governing the stock market. From the project, I achieved my first goal, by gaining experience in understanding and interpreting the behavior of the stock market. My second goal was to learn how to analyze data. By experimenting with technical and swing trading, I acquired the basic skills to analyze stocks using a variety of different tools and techniques. My third objective was to relate current events to stock price trends. During the project, I did research on the companies along the way, aware of the news, and conducted a fundamental analysis MACD chart, and historical stock price trend.

To sum up, this project was a very rewarding experience. What I have learned from this project is very valuable and could be extremely beneficial to my financial investments in the future. This project equipped me with the basic techniques and knowledge of participating in the American stock market.

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Appendix

Table A Technical Trading stock simulation profile

Date	Syml	Buy/Sell	Price	Share	Net Cost/Proceeds	Profit/Loss	Total Cash	Total Profit
1/16/18							$500,000.00	
1/17/18	AMZN	Buy	$1,298.45	30	$38,958.49	$-	$461,041.51	$-
1/17/18	ABBV	Buy	$103.25	372	$38,413.99	$-	$422,627.52	$-
1/17/18	SBUX	Buy	$61.20	635	$38,864.45	$-	$383,763.07	$-
1/23/18	AMZN	Buy	$1,349.28	23	$31,033.44	$-	$352,729.63	$-
1/23/18	SBUX	Sell	$61.68	500	$30,840.00	$240.00	$383,569.63	$240.00
1/31/18	ABBV	Buy	$115.38	50	$5,769.00	$-	$377,800.63	$-
1/31/18	SBUX	Sell	$56.15	100	$5,615.00	-$505.00	$383,415.63	-$265.00
2/6/18	AMZN	Sell	$1,428.16	53	$75,692.48	$5,705.54	$459,108.11	$5,440.54
2/6/18	ABBV	Sell	$111.99	422	$47,259.78	$3,081.78	$506,367.89	$8,522.32
2/6/18	SBUX	Sell	$55.50	35	$1,942.50	-$199.50	$508,310.39	$8,322.82
2/12/18	AMZN	Buy	$1,383.98	30	$41,519.40	$-	$466,790.99	$-
2/12/18	ABBV	Buy	$112.26	300	$33,678.00	$-	$433,112.99	$-
2/12/18	SBUX	Buy	$55.68	300	$16,704.00	$-	$416,408.99	$-
2/16/18	AMZN	Sell	$1,453.43	30	$43,602.90	$2,083.50	$460,011.89	$10,406.32
2/16/18	ABBV	Sell	$118.38	300	$35,514.00	$1,836.00	$495,525.89	$12,242.32
2/16/18	SBUX	Sell	$56.60	300	$16,980.00	$276.00	$512,505.89	$12,518.32

Table B Swing Trading stock simulation profile

Date	Syml	Buy/Sell	Price	Share	Net Cost/Proceeds	Profit/Loss	Total Cash	Total Profit
							$500,000.00	
1/16/18	GOOG	Buy	$1,140.31	10	$11,403.10	$-	$488,596.90	$-
1/18/18	GOOG	Buy	$1,124.90	24	$26,997.60	$-	$461,599.30	$-
1/17/18	REGN	Buy	$373.65	103	$38,485.95	$-	$423,113.35	$-
1/17/18	NFLX	Buy	$218.98	173	$37,883.54	$-	$385,229.81	$-
1/23/18	GOOG	Buy	$1,172.67	21	$24,626.07	$-	$360,603.74	$-
1/23/18	NFLX	Sell	$249.31	100	$24,931	$3,033.00	$385,534.74	$3,033.00
1/31/18	REGN	Buy	$366.65	50	$18,332.50	$-	$367,202.24	$-
1/31/18	GOOG	Buy	$1,182.22	20	$23,644.40	$-	$343,557.84	$-
1/31/18	NFLX	Buy	$270.30	50	$13,515.00	$-	$330,042.84	$-
2/6/18	NFLX	Buy	$265.72	100	$26,572.00	$-	$303,470.84	$-
2/12/18	GOOG	Buy	$1,056.65	10	$10,566.50	$-	$292,904.34	$-
2/12/18	REGN	Buy	$343.43	10	$3,434.30	$-	$289,470.04	$-
2/16/18	GOOG	Sell	$1,106.95	85	$94,090.75	$3,146.92	$383,560.79	-$113.92
2/16/18	REGN	Sell	$332.75	163	$54,238.25	$6,014.50	$437,799.04	$6,128.42
2/16/18	NFLX	Sell	$278.55	223	$62,116.65	$6,044.11	$499,915.69	-$84.31