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A Four-week Stock Simulation Research by Yuxin Wu and Chengyu Jiang

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Abstract

This project is a four-week stock simulation research. The goal of the project is for the two team members to learn stock trading strategies through a real-time simulation so that they can make wise and proper decisions on stock investment in the future. This project reviewed the current stock market, analysed two popular trading techniques and ran stock simulations on ten selected companies with an investment of $500,000 for each trading method. The results indicated that the Day Trading method is more profitable than the Swing & News Trading method in short-term investment (one month). This project provided the team members with valuable trading experiences that will be beneficial to future investments.

Acknowledgements

The success of our Interactive Qualifying project (IQP) would not have been possible without the help of many individuals. Firstly, and most importantly, we would like to thank Professor Tang for his continuous support and guidance throughout the project. Furthermore, we would like to express our gratitude towards our school, Worcester Polytechnic Institute (WPI) for the logistical support and pacification. The project would not have reached this point if it was not for the school's countless recommendations and guidance in solidifying our project.

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Chapter 1. Introduction

The goal of this project is to understand the basic and fundamental principles governing the stock market, to learn how to analyse and apply the two selected trading methods in the stock market simulation to get a real trading experience, and to relate current events to stock price trends. To accomplish these goals, we will first review the history of the stock market. We will identify important factors influencing the stock market and investigate how current events may influence the specific stock values. What's more, we will analyse techniques for assessing stock prices and values. By reviewing the current techniques and tools people use to trade stocks, we will identify ten 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 July 2nd to July 29th in 2018. The simulation results will compare the pros and cons of the two selected trading methods. By the end of this project, we aim to gain some initial experiences in stock trading and be able to make well-informed investment decisions.

1.1 Stock Market and Its History

A stock market, equity market or share market is the aggregation of buyers and sellers (a loose network of economic transactions, not a physical facility or discrete entity) of stocks (also called shares), which represent ownership claims on businesses; these may include *securities* listed on a public stock exchange as well as those only traded privately. Examples of the latter include shares of private companies which are sold to investors through equity crowdfunding platforms. Stock exchanges list shares of common equity as well as other security types, e.g. corporate bonds and convertible bonds.

In the 17th and 18th centuries, the Dutch pioneering several financial innovations that helped lay the foundations of modern financial system. While the Italian city-states produced the first transferable government bonds, they did not develop the other ingredient necessary to produce a fully-fledged capital market: the stock market. In the early 1600s the Dutch East India Company (VOC) became the first company in history to issue bonds and shares of stock to the general public. As Edward Stringham (2015) notes, "companies with transferable shares date back to classical Rome, but these were usually not enduring endeavours and no considerable secondary market existed (Neal, 1997, p. 61)." The Dutch East India Company (founded in the year of 1602) was also the first joint-stock company to get a fixed capital stock and as a result, continuous trade in company stock occurred on the Amsterdam Exchange.

Soon thereafter, a lively trade in various derivatives, among which options and repos, emerged on the Amsterdam market. Dutch traders also pioneered short selling – a practice which was banned by the Dutch authorities as early as 1610. Amsterdam-based businessman Joseph de la Vega's *Confusion de Confusiones* (1688) was the earliest known book about stock trading and first book on the inner workings of the stock market (including the stock exchange).

There are now stock markets in virtually every developed and most developing economies, with the world's largest markets being in the United States, United Kingdom, Japan, India, China, Canada, Germany (Frankfurt Stock Exchange), France, South Korea and the Netherlands [1].

1.2 Important Factors of Stock Market

The stock market, which is unstable and unpredictable, is always influenced by multitudes of factors. However, all these factors could be classified into four categories.

The first factor is the economics factor. Macroeconomic factors such as interest rates, inflation, unemployment and economic growth often move stock markets. Stock markets are always rooting for more economic growth, because it usually means more profits for companies and more profits tend to grow the value of stocks. Declining interest rates often send markets higher, because they are seen as a harbinger of economic growth. High inflation has the opposite effect, because it signals that interest rates will be rising in the immediate or near future, thus slowing economic growth. Rising unemployment foreshadows lower economic growth, and falling unemployment tells stock investors that growth is on the way.

The second one is the politics factor. A belief by investors that control of the government by one party or the other will hurt or benefit them can move the market as whole. This is especially true in times of intense domestic turmoil. Significant developments abroad also can affect U.S. markets. An election involving one of our major trading partners that brings to power an avowedly hostile government can push markets lower. However, the converse is also true. The election of a friendly foreign government can move markets higher. These are scenarios we might see in trading partners with democracies. In non-democratic countries with which we trade, coups, general strikes and revolutions may be more likely. The positive or negative effect on the stock market would depend on the country and the circumstances, but uncertainty generally moves markets lower.

The third factor is the influence of natural and human-made disasters. Natural or human-made disasters with economic consequences also affect stock markets. If an earthquake happens in a bustling city where there's lots of economic activity, markets will move down as investors fear a negative impact on economic growth. Similarly, if there's a disaster at a man-made facility of economic importance, such as an oil refinery blowing up, it can put downward pressure on stock prices.

The last one is the market psychology. Market psychology refers to the manner in which the market reflects its participants' collective emotional state, which directly impacts price movements and trends. *Market psychology*is the overall feeling among market participants that impels them to buy or sell. For this reason, an upward -- or bullish -- trend is associated with feelings of positive expectations expressed by optimism and hopefulness. By contrast, a downward -- or bearish -- trend correlates with feelings of pessimistic expectations expressed by anxiety and fear [2].

1.3 Stock Market Index

A stock index or stock market index is a measurement of a section of the stock market. It is computed from the prices of selected stocks (typically a weighted average). It is a tool used by investors and financial managers to describe the market, and to compare the return on specific investments.

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. Each of these stock indices have various divisions concentrated on different industries [3]. This section reviews the five most significant indices in America and their subordinate indices.

1.3.1 Dow Jones Industrial Average

The Dow Jones Industrial Average (DJIA), or the Dow, is a stock market index that shows how 30 large, publicly owned companies based in the United States have traded during a standard trading session in the stock market. The value of the Dow is not a weighted arithmetic mean and does not represent its component companies' market capitalization, but rather the sum of the price of one share of stock for each component company. The sum is corrected by a factor which changes whenever one of the component stocks has a stock split or stock dividend, so as to generate a consistent value for the index [4].

1.3.2 Nasdaq Composite

The NASDAQ Composite[l] is a stock market index of the common stocks and similar securities listed on the NASDAQ stock market. Along with the Dow Jones Average and S&P 500 it is one of the three most-followed indices in US stock markets. The composition of the NASDAQ Composite is heavily weighted towards information technology companies [5].

1.3.3 S&P 500 Index

The Standard & Poor's 500, often abbreviated as the S&P 500, or just the S&P, is an American stock market index based on the market capitalizations of 500 large

companies having common stock listed on the NYSE or NASDAQ. The S&P 500 index components and their weightings are determined by S&P Dow Jones Indices. It differs from other U.S. stock market indices, such as the Dow Jones Industrial Average or the Nasdaq Composite index, because of its diverse constituency and weighting methodology. It is one of the most commonly followed equity indices, and many consider it one of the best representations of the U.S. stock market, and a bellwether for the U.S. economy. The National Bureau of Economic Research has classified common stocks as a leading indicator of business cycles [6].

1.3.4 Russell 2000 Index

The Russell 2000 Index is a small-cap stock market index of the bottom 2,000 stocks in the Russell 3000 Index. The index is maintained by FTSE Russell, a subsidiary of the London Stock Exchange Group.

The Russell 2000 is by far the most common benchmark for mutual funds that identify themselves as "small-cap", while the S&P 500 index is used primarily for large capitalization stocks. It is the most widely quoted measure of the overall performance of the small-cap to mid-cap company shares. The index represents approximately 8% of the total market capitalization of the Russell 3000 Index. As of 31 December 2017, the weighted average market capitalization for a company in the index is around $2.4 billion; the median market cap is $861 million. The market cap of the largest company in the index is almost $9.3 billion. It first traded above the 1,000 level on May 20, 2013.

Similar small-cap indices include the S&P 600 from Standard & Poor's, which is less commonly used, along with those from other financial information providers [7].

1.3.5 MSCI EAFE

The MSCI EAFE Index is a stock market index that is designed to measure the equity market performance of developed markets outside of the U.S. & Canada. It is maintained by MSCI Inc., a provider of investment decision support tools; the EAFE acronym stands for Europe, Australasia and Far East.

The index is market-capitalization weighted. It first ranks each stock in the investable universe from largest to smallest by market capitalization. The largest 70% will compose the MSCI EAFE Large Cap (new index), the largest 85% will compose the MSCI EAFE Standard, and the largest 99% will compose the MSCI Investable Market index ("IMI"). The 71st to 85th percentiles represent the MSCI EAFE Mid Cap, and the 85th to 99th percentiles represent the MSCI EAFE Small Cap.

The index includes a selection of stocks from 21 developed markets but excludes those from the U.S. and Canada. The index has been calculated since 31 December 1969, making it the oldest truly international stock index. It is probably the most common benchmark for foreign stock funds in the U.S [8].

1.4 WPI Past Researches on Stock Simulation

This section mainly focuses on the stock simulation researches, or the related ones, which are initiated by the WPI undergraduate students or graduate students. One of these researches is the stock simulation project, which 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 trading strategy.

However, the stock market is unstable as mentioned before. It is hard to say that any of the conclusions of the projects are right or correct. Thus, our project may give us a totally different result and conclusion, compared with the former projects.

1.5 Stock Market Crashes and Its History

A stock market crash is a sudden dramatic decline of stock prices across a significant cross-section of a stock market, resulting in a significant loss of paper wealth. Crashes are driven by panic as much as by underlying economic factors. They often follow speculative stock market bubbles.

Stock market crashes are social phenomena where external economic events combine with crowd behaviour and psychology in a positive feedback loop where selling by some market participants drives more market participants to sell. Generally speaking, crashes usually occur under the following conditions: a prolonged period of rising stock prices and excessive economic optimism, a market where P/E ratios exceed long-term averages, and extensive use of margin debt and leverage by market participants. Other aspects such as wars, large-corporation hacks, changes in federal laws and regulations, and natural disasters of highly economically productive areas may also influence a significant decline in the NYSE value of a wide range of stocks. All such stock drops may result in the rise of stock prices for corporations competing against the affected corporations.

There is no numerically specific definition of a stock market crash but the term commonly applies to steep double-digit percentage losses in a stock market index over a period of several days. Crashes are often distinguished from bear markets by panic selling and abrupt, dramatic price declines. Bear markets are periods of declining stock market prices that are measured in months or years. Crashes are often associated with bear markets, however, they do not necessarily go hand in hand. The crash of 1987, for example, did not lead to a bear market. Likewise, the Japanese bear market of the 1990s occurred over several years without any notable crashes [9].

There are several crashes on the history of American stock market, which are the Panic of 1907, the Wall Street Crash of 1929, the October 19, 1987 and the Crash of 2008-2009.

Chapter 2. Methodology

2.1 Stock Simulation Engine

There are multitudes of stock simulation engines on different websites, such as the Virtual Stock Exchange (VSE) from Market Watch, the Wall Street Survivors, How the Market Works, the Weseed and the Investopedia Simulator.

This project will take the Investopedia Simulator as the simulation engine, since Investopedia not only uses the real data from the stock market to do the simulation, but also is a reliable finance and economy website for people to browse and use.

To start the simulation, users must set the initial conditions of the simulation as they wanted. Figures 2.1.1.and 2.1.2. showed the initial conditions of this (simulation) project.

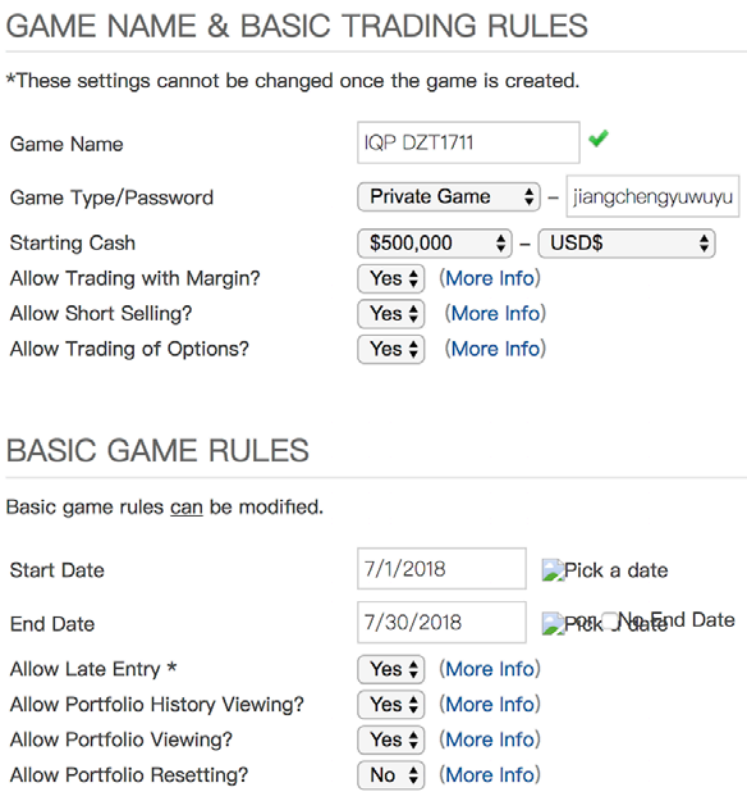

Figure 2.1.1. Initial Conditions of the Simulation

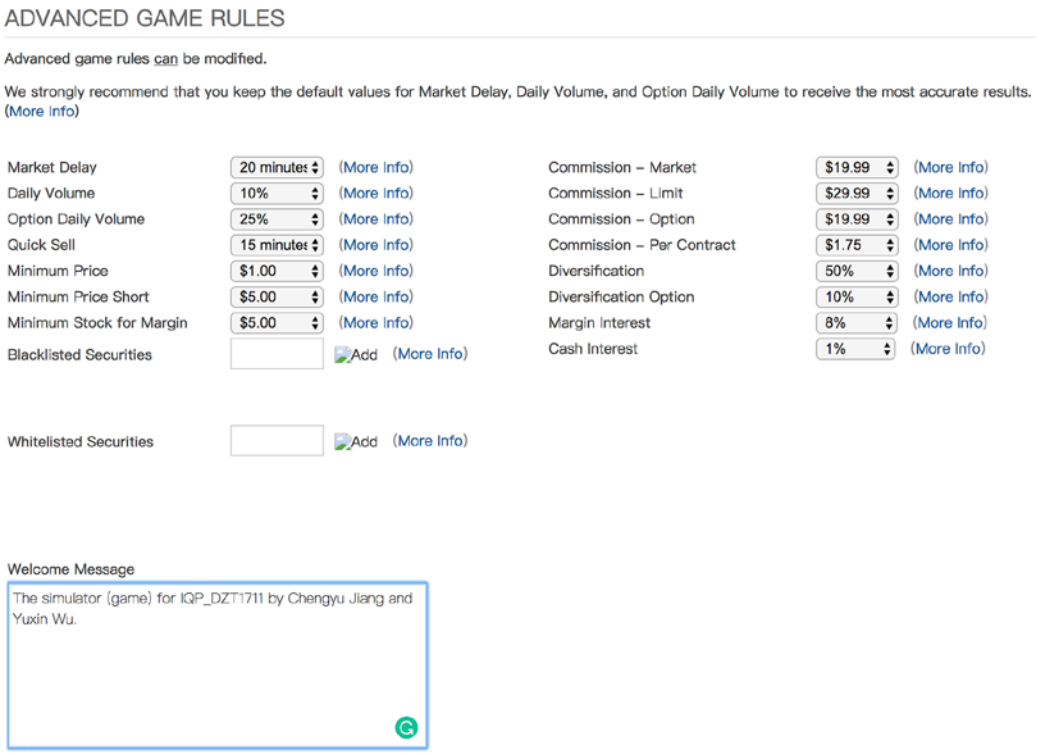

Figure 2.1.2. Initial Conditions of the Simulation

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. 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. 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.

2.2 Stock Trading Strategies

2.2.1 Swing Trading and News Trading

Swing trading is a speculative trading strategy in financial markets where a tradable asset is held for between one and several days in an effort to profit from price changes or 'swings'. A swing trading position is typically held longer than a day trading position, but shorter than buy and hold investment strategies that can be held for months or years. Profits can be sought by either buying an asset or short selling. Momentum signals have been shown to be used by financial analysts in their buy and sell recommendations that can be applied in swing trading.

Using a set of mathematically based objective rules for buying and selling is a common method for swing traders to eliminate the subjectivity, emotional aspects, and labour-intensive analysis of swing trading. The trading rules can be used to create a trading algorithm or "trading system" using technical analysis or fundamental analysis to give buy and sell signals (Wikipedia, 2018).

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.

News trading involves either buying or selling the shares of a stock immediately after a major news event. This strategy has always been used to trade foreign exchange and oil market. Since the price of the stock is sensitive to people’s expectations for the market, which could be readily influenced by the news, people can predict the change of

the stock price by understanding the related news and use this as a method to get profits in the stock market.

2.2.2 Day Trading

Day trading strategy is the method might be used by many beginners. Since this program only last for 4 weeks. Day trading strategy is considered to be a suitable method for this program. Day trading is the method of buying and selling within the same day. Strictly, day trading is trading only within a day, such that all positions are closed before the market closes for the trading day.

However, many traders would not follow the rule so strictly or consider day trading as one component of overall strategy. Traders who trade in this capacity with the motive of profit are therefore speculators. The methods of quick trading contrast with the long-term trades underlying buy and hold and value investing strategies (Wikipedia 2018).

The work of a day trader is very busy, to say the least. These traders enter and exit numerous positions over the course of a single day. Their trading is defined by the fact that they never hold positions from one trading day to the next. They are “intra-day” traders, meaning that they execute multiple trades over the course of a single day.

Traders can exit the position once their buying cannot gain profit and reduce loss once the risks are being noticed. Whether this method is a get-rich-quick scheme will be discussed in the project.

2.3 Data Analysis Method

There were two basic methodologies investors rely upon when the objective of the analysis is to determine what stock to buy and at what price. Fundamental analysis and

Technical analysis. Investors can use one of both of these complementary methods for stock pricing and making investment decisions.

2.3.1 Fundamental Analysis

Fundamental analysis is the analysis of a business's financial statements, health and its competitors and markets. in accounting and finance. This analysis method usually used to analyse the business's assets, liabilities and earnings. It considers he overall state of the economy and factors including interest rates, production, earnings, employment, GDP, housing, manufacturing and management. This analysis method is performed on historical and present data, but with the goal of making financial forecasts.

Fundamental analysis method includes three different sub-analysis types: Economic analysis, Industry analysis and Company analysis. The intrinsic value of the shares is determined based upon these three analyses. It is this value that is considered the true value of the share. If the intrinsic value is higher than the market price, buying the share is recommended. If it is equal to market price, it is recommended to hold the share and if it is less than the market price, then one should sell the shares.

2.3.2 Technical Analysis

Fundamental analysts examine incomes, dividends, assets, quality, ratio, new products etc. Technicians, however, employs many methods, tools and techniques. One of which is the use of charts. Using charts, technical analysts seek to identify price patterns and market trends in financial markets and attempt to exploit those patterns. Therefore, in finance, technical analysis is an analysis methodology for forecasting the direction of prices through the study of past market data, primarily price and volume.

A core principle of technical analysis is that a market's price reflects all relevant information impacting that market. Therefore, this analysis method is focus on the history of a security or commodity trading pattern rather than external drivers such as economic, fundamental and news events. There are three main points need to keep in mind when analyse the market.

First, Market action discounts everything. This means that based on the premise, all relevant information is already reflected by prices. Second, Prices move in trends. In technical analysis, prices trend directionally, such as move up, down, sideways or some combination. Third, History tends to repeat itself. According to technical analysis, investors collectively repeat the behaviour of the investor that preceded them.

Chapter 3. Simulation 1: Swing Trading and News Trading Strategy

3.1 Selection of Companies

3.1.1 NIKE (NKE)

Nike, Inc. is an American multinational corporation that is engaged in the design, development, manufacturing, and worldwide marketing and sales of footwear, apparel, equipment, accessories, and services. The company is headquartered near Beaverton, Oregon, in Portland metropolitan area. It is the world's largest supplier of athletic shoes and apparel and a major manufacturer of sports equipment, with revenue in excess of US $24.1 billion in its fiscal year 2012. In 2014 the brand alone was valued at $19 billion making it the most valuable brand among sports businesses. As of 2017, the Nike brand is valued at $29.6 billion. Figure 3.1.1. gives the 10-Year Price Chart for Nike, Inc (NKE).

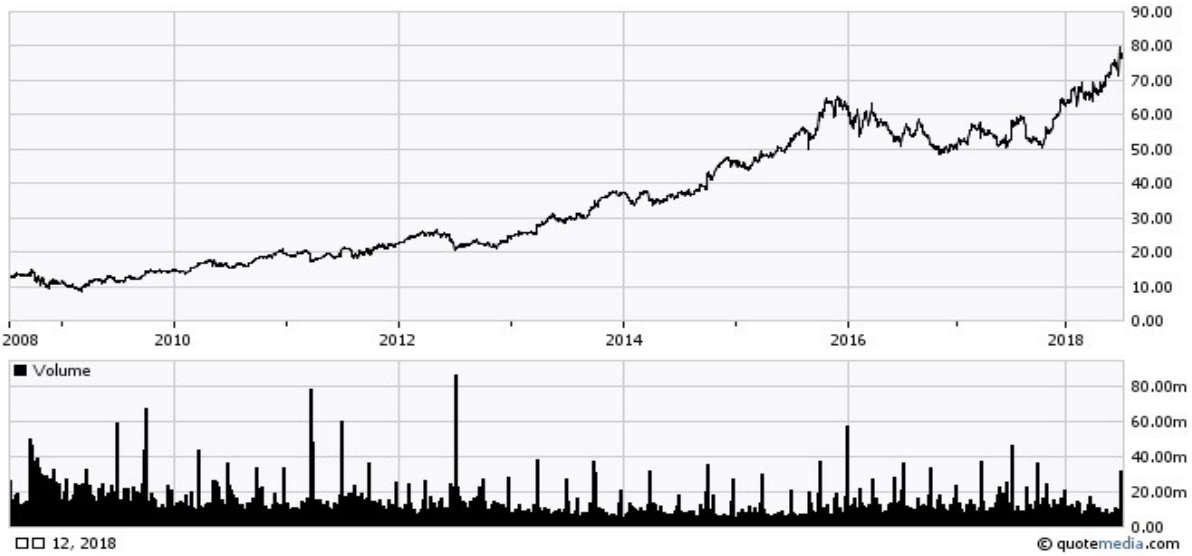

Figure 3.1.1. 10 Years Stock Price Chart for Nike, Inc (NKE)

3.1.2 Google LLC (GOOGL)

Google LLC is an American multinational technology company that specializes in Internet-related services and products, which include online advertising technologies, search engine, cloud computing, software, and hardware. Google was founded in 1998 by Larry Page and Sergey Brin. Since July 2015, the share price of Google has been on the rise, but it has stagnated at a record high of around $1200 at the end of January. When the company announced its fourth quarter results in early February, its share price plummeted and failed to impress investors. However, it managed to gain technical support at the price of US $1000 for the three time and established the pattern of technology reversal. At present, the stock price seems to be breaking down, and may lead to a down ward trend in the stock price to nearly $1150, which is about 7% higher than the current price. Figure 3.1.2 gives the 10-Year Price Chart for Google (GOOGL).

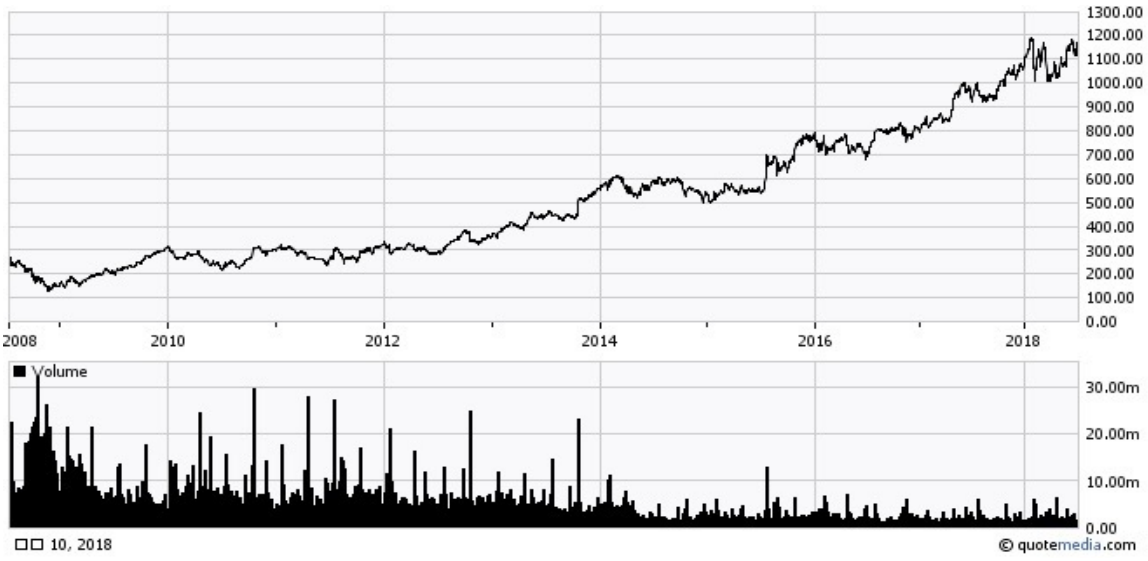

Figure 3.1.2. 10 Years Stock Price Chart for Google (GOOGL)

3.1.3 Apple Inc. (AAPL)

Apple Inc. is an American multinational technology company headquartered in Cupertino, California, that designs, develops, and sells consumer electronics, computer software, and online services. The company's hardware products include the iPhone smartphone, the iPad tablet computer, the Mac personal computer, the iPod portable media player etc. Apple's software includes the macOS and iOS operating systems, the iTunes media player, the Safari web browser etc. Apple was founded by Steve Jobs, Steve Wozniak, and Ronald Wayne in April 1976. Cash flow always can reflect business conditions more realistically. Therefore, investors could use the ratio between Enterprise Value and Free Cash Flow (EV/FCF) to assess the stock value. The smaller the ratio is the higher the stock value. The ratio of Apple Inc. is about 8 which is about half of the price earnings ratio. Apple Corp's ratio between Enterprise value and Free Cash Flow are higher than the standard Poor's average of 6, which means that the company's stock is worth investing. So AAPL should be chosen in this project. Figure 3.1.3. shows the 10-Year Stock Price Chart for Apple Inc. (AAPL).

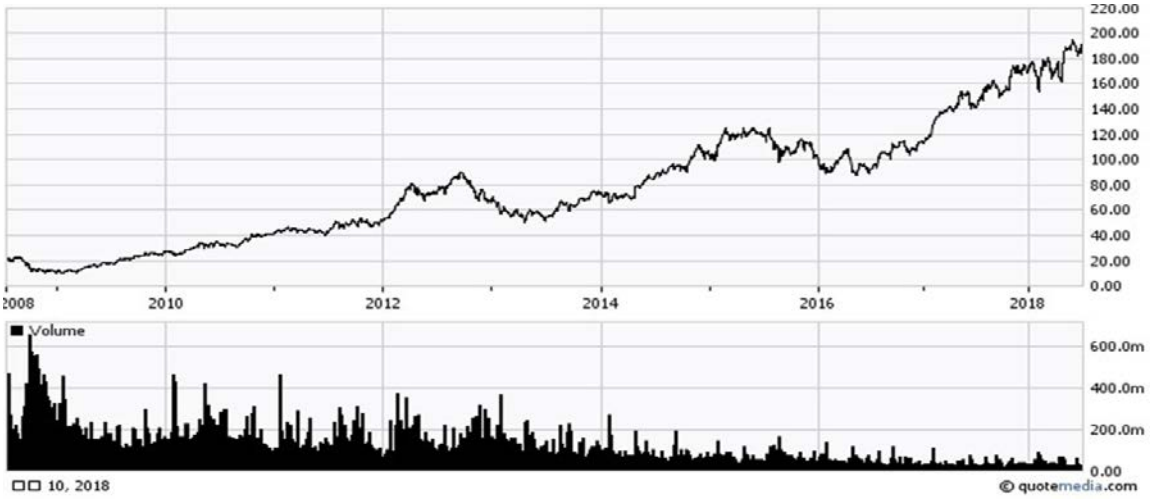

Figure 3.1.3. 10 Years Stock Price Chart for Apple Inc. (AAPL)

3.2 Week One Simulation

My initial investment is roughly equal to $62,500 each. The total value of investment on each stock are various depending on the company's net profit margin and its historical trends. Table 3.2.1. below shows the first trade of in the simulator. Each of the trade cost $19.99 commission fee.

Date	Symbol	Buy/ Sell	Price	Shares	Net Costs/ Proceeds	Profits/ Loss	Total Cash	Total Profits
							$500,000.00	
7/9/18	GOOGL	Buy	$1,157.74	54	$62,537.95	$0	$437,462.05	$0
7/9/18	NKE	Buy	$76.72	815	$62,546.79	$0	$374,915.26	$0
7/9/18	AAPL	Buy	$189.74	329	$62,444.45	$0	$312,470.81	$0

Table 3.2.1. The Initial Investment (on the three Companies)

In the first week, I choose three companies which I am familiar with. All the three companies are stable and have good reputations among people. Since I use Swing Trading and News Trading on my investment, I have started to trace the news of the three companies (and any related news) and the stock charts of them.

Figures 3.2.1., Figure 3.2.2. and Figure 3.2.3. are the 5-day stock charts of AAPL, GOOGL and NKE on July 13th (All the figures show the trends of the stocks between July 9th and 13th).

Figure 3.2.1. 5-Day Price Chart of AAPL

As seen in Figure 3.2.1., AAPL showed a sudden decrease followed by rapid increase, which made the price back to the standard level. The highest point of the uptrend is $191.76, and the lowest point of the downtrend is $187.82. If we buy the stock at a price of $189.74, then the risk to reward ratio is 0.95. 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:

($189.74 - $187.82) / ($191.76 - $189.74) = 0.95, (1)

The ratio is less than 1.0, which indicates the profit potential is greater than the risk potential. However, some media reported that Apple was planning to cooperate with Spotify on Apple Music. I believe this news will snag the price of AAPL to some extent. I

decided to hold all the shares and expected them to reach the resistance level.

Figure 3.2.2. 5-Day Price Chart of GOOGL

As seen in Figure 3.2.2., GOOGL showed some stable increases. The highest point of the uptrend is $1,210.35 and the lowest point of the downtrend is $1,163.57. The purchase price of the stock is $1,157.74. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$1{,}163.57) / (\$1{,}210.35 - x) < 1.0, \quad (2)$$

However, during the whole week, the stock price didn't fall into the expected range that the profit potential is larger than the risk potential. With this information, I decided to hold GOOGL stock and expected it to reach the resistance level.

Figure 3.2.3. 5-Day Price Chart of NKE

As seen in Figure 3.2.3., the highest point of the uptrend is $78.06, and the lowest point of the downtrend is $76.93. The purchase price, $76.72, was less than the lowest point of the downtrend. The equation to calculate the risk to reward ratio is shown below:

$$(X - \$76.72) / (\$78.06 - x) < 1.0, \quad (3)$$

Since the final of 2018 World Cup will be held this weekend. More importantly, the two teams, in the final, are all sponsored by Nike. I decided to buy another 2000 shares of NKE on July 13th. Table 3.2.2. shows the details of the buying.

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/ Proceeds	Profits/ Loss	Total Cash	Total Profits
7/13/18	NKE	Buy	$77.39	1000	$77,409.99	$0	$235,060.82	$0
7/13/18	NKE	Buy	$77.41	1000	$77,429.99	$0	$157,630.83	$0

Table 3.2.2. The Buying of NKE on July 13th

3.3 Week Two Simulation

As what I had expected, the stock price of NKE raised after the final of 2018 World Cup. However, the increment of the price was not as big as I had thought. But, I still decided to sell all shares of NKE on July 17th. Table 3.3.1. shows my all my trades on July 17th.

Date	Symbol	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profits/Loss	Total Cash	Total Profits
7/17/18	NKE	Sell	$77.51	2815	$218,170.66	$783.89	$375,801.49	$783.89
7/17/18	GOOGL	Sell	$1,196.09	54	$65,568.87	$3030.92	$441,370.36	$3814.81

Table 3.3.1. All the Trades on July 17th

I also decided to sell all the shares of GOOGL to lock the profit on July 17th, since I believed that GOOGL reached the resistance level at that time. After that, I was waiting for the decrement of the price, which means the price reached the new support level. Figure 3.3.1. shows the price chart of GOOGL from July 9th to July 19th.

Figure 3.3.1. Price Chart of GOOGL from July 9th to July 19th

At the midnight of July 17th, European Commission announced to fine Google €4.34 billion for illegal practices regarding Android mobile devices to strengthen dominance of Google's search engine. According to this influential news, I thought the stock price of GOOGL would decreased a lot on July 18th, which means it could reach a new support level at that time. In other words, I thought July 18th was a good time to buy shares of GOOGL. Figure 3.3.2. shows the price chart of GOOGL from July 17th to July 21st. According to this figure, I realized that I predicted the time of reaching support level, which was around July 20th, wrongly.

Figure 3.3.2. Price Chart of GOOGL from July 17th to July 21st

Figure 3.3.3. shows the price chart of NKE from July 17th to July 21st. On July 18th, the price of NKE underwent a sheer decrement, which convinced me that NKE reached a new support level and it was a good time to buy the shares of NKE. However, there was not any news negatively influenced Nike and the stock price of NKE. Because of that, I could not explain the sharp decrement through news.

Figure 3.3.3. Price Chart of NKE from July 17th to July 21st

According to this figure, my decision, which was buying NKE on July 18th, was a wise decision. I bought the shares at a relatively low price. After that, I have waited for the price of NKE decreased to the support level, which would be a good time to sell the shares and get the profits.

The Figure 3.3.4. and Figure 3.3.5. illustrates the stock price of AAPL from July 8th to 21st and from July 15th to 21st.

Figure 3.3.4. Price Chart of AAPL from July 8th to July 21st

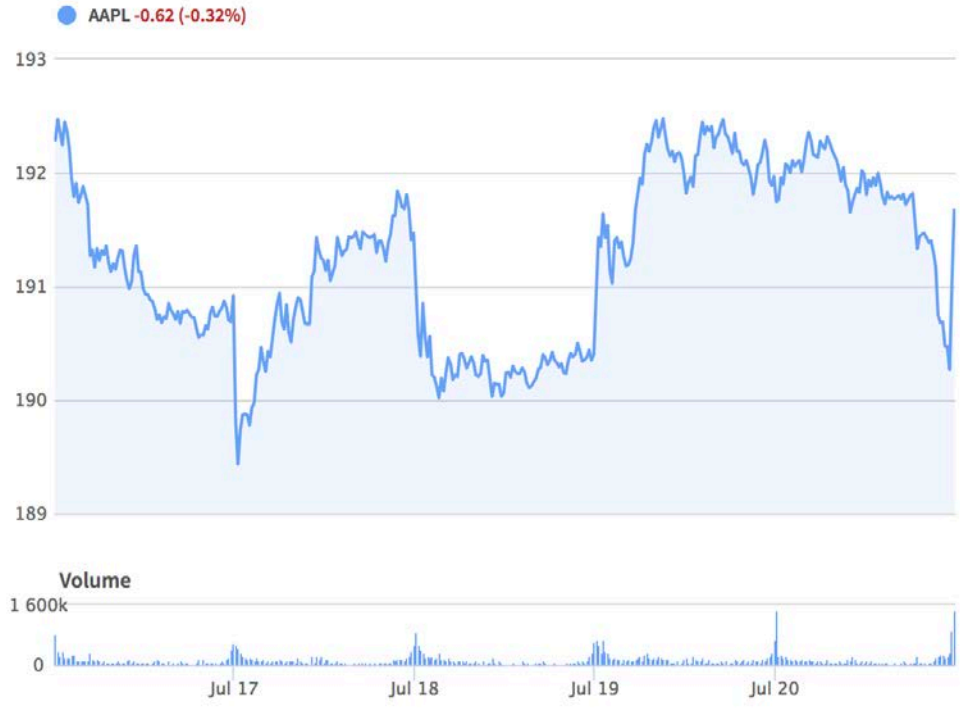

Figure 3.3.5. Price Chart of AAPL from July 15th to July 21st

The price of AAPL increased to $192.37 at 10:00 AM July 16th, which was a good time for me to sell some shares of AAPL to lock some profits. However, I thought the price could be much higher in the upcoming hours in the same day. These figures show that my opinion was wrong. The price of AAPL fell back to $190 in the upcoming days. After experienced a sharp decrement on July 18th, the price of AAPL backed to $189 again. Thus, I decided to buy more shares of AAPL and expected these to increase to the new resistance level in the future.

Table 3.3.2. shows all the trades on July 18th.

Date	Symbol	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profits/ Loss	Total Cash	Total Profits
7/18/18	NKE	Buy	$77.02	2162	$166,537.23	$0	$277,833.13	$3,814.81
7/18/18	GOOGL	Buy	$1,206.93	138	$166,576.33	$0	$108,256.80	$3,814.81
7/18/18	AAPL	Buy	$189.99	300	$57,016.99	$0	$51,239.81	$3,814.81

Table 3.3.2. All the Trades on July 18th

3.4 Week Three Simulation

Since I had already bought the desired shares of the three stocks, I mainly focused on finding the resistance level of the stocks and the news which could make the prices of stocks to reach the resistance level.

Figure 3.4.1. shows the stock price of NKE from July 18th to July 26th.

Figure 3.4.1. Price Chart of NKE from July 18th to July 26th

My buying price of NKE was $77.02, which was followed a sheer decrement of price, on July 18th. Thus, I have to await the price bounces up $77.02 to get profits. Or, I could wait for the price of NKE goes down to a desired level and buy more shares of NKE at that time to decrease the average price of the total shares. I decided to wait for the increment of the price, since the transfer of Cristiano Ronaldo, a soccer player who was sponsored by Nike, could motivated the market of Nike.

Figure 3.4.2. illustrates the stock price of GOOGL, which had increased a lot, from July 18th to July 26th.

Figure 3.4.2. Price Chart of GOOGL from July 18th to July 26th

The close price on July 23rd, which was $1211.85, underwent a large increment and reached $1,262.72, which was the open price of GOOGL on July 24th. The reason of the large increment was the subsequent reaction of the announcement of European Commission that the commission planned to fine Google €4.34 billion. After the announcement, President Trump said that the negative influences of the fine would not stay for long, which means that he thought the fine would not affect the development of Google for long. His sentences made the public to be confident in Google, which increased the price of GOOGL a lot. I decided to keep all shares of GOOGL, since I believed it could rose to higher price level.

Figure 3.4.3. shows the stock price of AAPL from July 23rd to July 27th.

Figure 3.4.3. Price Chart of AAPL from July 23rd to July 27th

As seen in Figure 3.4.3., AAPL had some stable increases. The highest point of the uptrend is $195.65, and the lowest point of the downtrend is $190.14. The purchase price of the stock is $189.86. The equation to calculate the risk to reward ratio is shown below:

($189.86 - $190.14) / ($195.65 – $189.86) < 1.0, (4)

Since the ratio is less than 1.0, I decided to keep all the shares of AAPL and wait for it to rise to the expected price.

3.5 Week Four Simulation

This week, I sold all the shares that had bought, since all of those either reached the expected resistance level or were sold to control the loss. Table 3.5.1. shows all the trades in this week (from July 30th to August 3rd).

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/Proceeds	Profits/Loss	Total Cash	Total Profits
7/30/18	NKE	Sell	$75.62	2162	$163,459.64	-$3,077.59	$214,699.45	$737.22
7/30/18	GOOGL	Sell	$1,236.58	138	$170,628.05	$4,051.72	$385,327.50	$4,788.94
7/30/18	AAPL	Sell	$189.86	300	$56,938.01	-$78.98	$442,265.51	$4,709.96
8/3/18	AAPL	Sell	$207.98	329	$68,405.43	$5,960.98	$510,670.94	$10.670.94

Table 3.5.1. All the Trades from July 30th to August 3rd

The reason I did these trades was simple. NKE was keeping decreasing this week. But it did not reach the expected support level, so I had to sell the shares to prevent the larger loss. Same reason went on the sale of AAPL on July 30th. However, I kept 329 shares of AAPL on that day. Since Apple would release their new product in the third quarter, which could stimulate the price of AAPL in a few days. Luckily, when I sold the rest shares on August 3rd, those gave me surprising $5,960.98 profits in total. Some media reported, on July 30th, that Google would exploit the Chinese market again, which increased the price of GOOGL sharply on the same day. Because of that, I sold all the shares of GOOGL to maximize the profits.

Chapter 4. Simulation 2: Day Trading Strategy

4.1 Selection of Companies

4.1.1 General Motors Company (GM)

General Motors Company, commonly referred to as General Motors (GM), is an American multinational corporation headquartered in Detroit that designs, manufactures, markets, and distributes vehicles and vehicle parts, and sells financial services. With global headquarters in Detroit's Renaissance Center, GM manufactures cars and trucks in 35 countries. In 2008, 8.36 million GM cars and trucks were sold globally under various brands. GM reached the milestone of selling 10 million vehicles in 2016. Current auto brands are Buick, Cadillac, Chevrolet, GMC, Holden, and Wuling. General Motors contains a lot of famous auto brands. These brand value has been increased during last few years. Therefore, General Motors Company has been chosen in this project. Figure 4.1.1. gives the 10 Years Stock Price Chart for General Motors Company (GM).

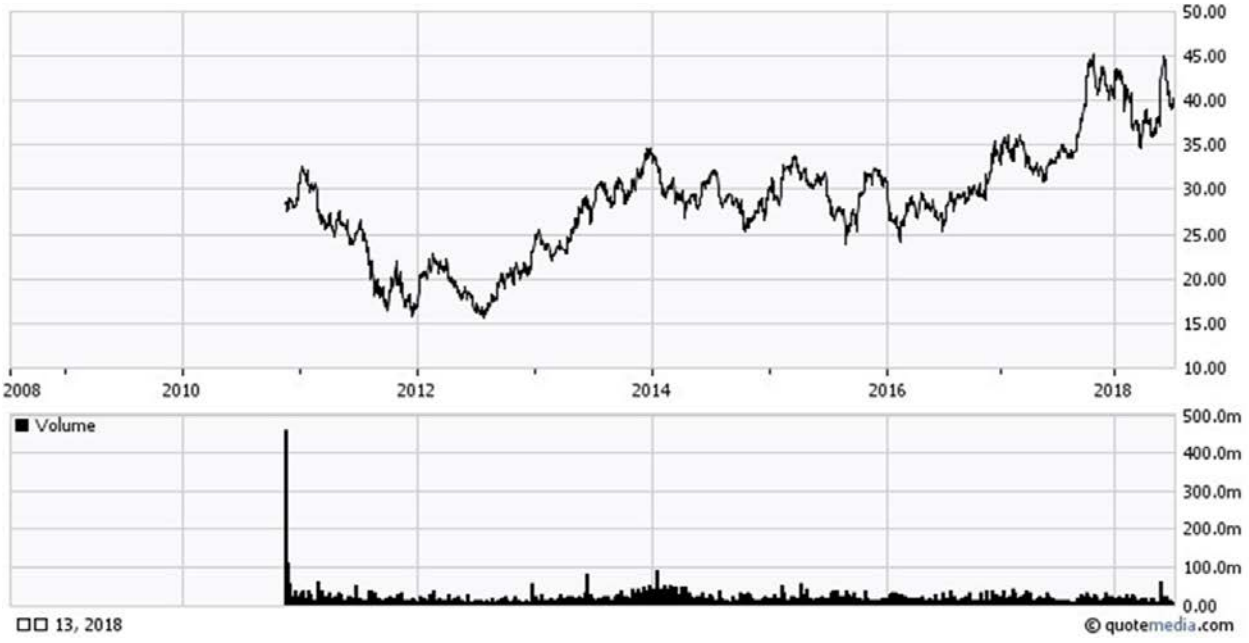

Figure 4.1.1. 10 Years Stock Price Chart for General Motors Company (GM)

4.1.2 FACEBOOK (FB)

Facebook is an American online social media and social networking service company which founded by Mark Zuckerberg. Facebook can be accessed from a large range of devices with Internet connectivity, such as desktop computers, laptops and tablet computers, and smartphones. After registering, users can create a customized profile and add other uses as “friends”. Most of Facebook’s revenue comes from advertising and other portion of revenue comes from the “firehose” access, bulk access to the social media data sold to the third parties. The total revenue of Facebook in December 2016 was $27,638 and it became to $40,653 in December 2017. Facebook has been one of the most popular choice of day trading since it is a suitable investment choice for small companies and individuals. Therefore, Facebook was selected in this project. Figure 4.1.2. gives the 2 Years Stock Price Chart for Facebook (FB).

Figure 4.1.2. 2 Years Stock Price Chart for Facebook (FB)

4.1.3 Microsoft Corporation (MSFT)

Microsoft Corporation is an American multinational technology company with headquarters in Redmond, Washington. It develops, manufactures, licenses, supports and sells computer software, consumer electronics, personal computers, and services. Its best-known software products are the Microsoft Windows line of operating systems, the Microsoft Office suite, and the Internet Explorer. Its flagship hardware products are the Xbox video game consoles and the Microsoft Surface line-up of touchscreen personal computers. The most valuable finding about the changing tendency of Microsoft Corporation Stock Price is that since Satya Nadella took the charge of Microsoft's CEO in 2014, the stock price has been increased about 200% during these 4 years. Until July 9, 2018, the stock price was $101.85, and it is keep increasing. Figure 4.1.3. gives the 10 Years Stock Price Chart for Microsoft Corporation (MSFT).

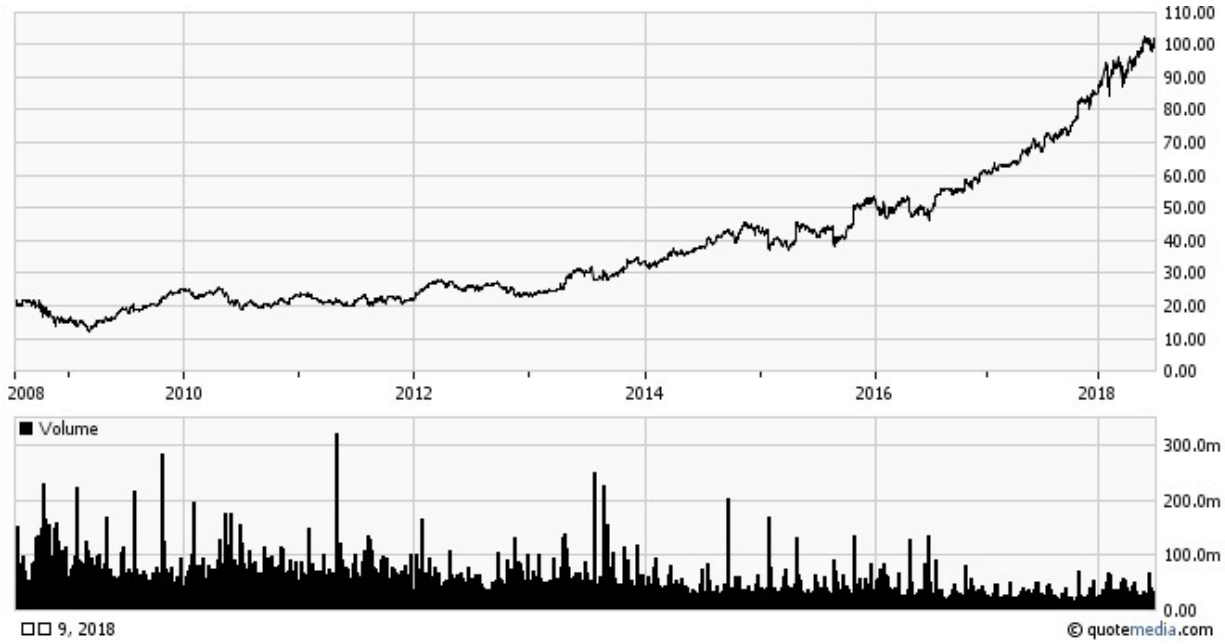

Figure 4.1.3. 10 Years Stock Price Chart for Microsoft Corporation (MSFT)

4.2 Week One Simulation

The average cost of each transaction is supposed to be around $125,265. But the accidental condition should also be considered during investment. Therefore, there were 1224 shares of FB stock were purchased which cost $248,819.21. The value of each stock to invest could be analysis by MACD indicator (Moving Average Convergence/Divergence). Table 4.2.1. shows the first five transactions in the simulator. Each transaction costed $19.99 commission fees.

Date	Symbol	Buy/Sell	Price	Shares	Net Cost/Proceeds	Profits/Loss	Total Cash	Total Profits
7/10/18	FB	Buy	$203.78	612	$124,713.36	$375,266.65	$124,733.35	$500,000.00
7/10/18	FB	Buy	$203.67	612	$124,646.04	$373245.97	$126,666.03	$499,912.69
7/10/18	MSFT	Buy	$102.27	1225	$125,280.75	$374237.00	$125,300.74	$499,537.74
7/10/18	GM	Buy	$40.19	3144	$126,357.36	$373125.58	$126,361.63	$499,487.21

Table 4.2.1. Initial investment on Stocks by using technical trading method

Investors usually use EMA (Exponential Moving Average) to analysis the tendency of stocks and the gaps between EMA 26 and EMA 12 can indicate whether the profits will increase of decrease in the future period. Therefore, comparing the gaps between EMA 26 and EMA 12 of each company will help investors to determine sell or buy the stocks. As shown in Figure 4.2.1., Figure 4.2.2. and Figure 4.2.3., the gaps of EMA is quite different with each other. These numerical values will help to make decisions.

Figure 4.2.1. General Motor's MACD Chart from 10th to 13th July 2018

Figure 4.2.2. Microsoft's MACD Chart from 10th to 13th July 2018

Figure 4.2.3. Facebook's MACD Chart from 10th to 13th July 2018

As shown in Figure 4.2.1., the Gap between EMA 12 and EMA 26 is 0.24. As shown in Figure 4.2. 2., the Gap between EMA 12 and EMA 26 is 0.13. As shown in Figure 4.2.3., the Gap between EMA 12 and EMA 26 is 0.34.

Since 0.34 > 0.24 > 0.13, investors should consider that purchase more FB's stocks and sell MSFT's stock in the future period. Even though there are some negative news about Facebook currently. Apparently, news is not the only factors that influence the tendency of stocks.

4.3 Week Two Simulation

Until July 22 in 2018, the second week of stimulator is ended. According to the data on Investopedia.com, the largest profit value is from Facebook, which is $7607.16. This result indicates that keeping Facebook's stock is a wise decision. Surprisingly, MSFT is not the one who caused loss as the predication said last week. Instead, after few days

depreciation, MSFT's value is keeping increase for second week. According to the data on July 18 in 2018, Amazon Inc.'s stock value is keeping increase. Therefore, purchasing AMZN's stocks will be the first decision that investors would consider about. However, the weekly conclusion of stocks' performance show that buying AMZN is not a good decision. AMZN's stocks did not make any profits even caused big lost. Table 4.3.1 shows the summary of the transactions of week 2. Figure 4.3.1., Figure 4.3.2. and Figure 4.3.3. show the MACD chart of FB, MSFT and GM from July 18th to July 20th.

Date	Symbol	Buy/Sell	Shares	Price	Net Cost/Proceeds	Profits/Loss	Total Cash	Total Profits
7/18/2018	AMZN	Buy	130	$1840.60	$239,278.00	$263,081.30	$239,297.99	$502,379.29
7/18/2018	MSFT	Sell	1220	$105.02	$128,124.40	$374,396.56	$128,104.41	$502,500.97

Table 4.3.1. The Summary of the Transactions of Week 2

Figure 4.3.1. Facebook's MACD Chart from July 18th to 20th in 2018

Facebook's MACD chart shows the gap between 26-week EMA and 12-week EMA is appearing decreasing tendency. This phenomenon means the value of Facebook's company will be decrease in the future period. Therefore, investors should sell their FB's stock as soon as possible to preventing losing money.

Figure 4.3.2. Microsoft Corporation's MACD Chart from July 18th to 20th in 2018

Microsoft Corporation's MACD chart shows there is almost no change between the 26-week EMA line and 12-week EMA line. Investors should not make any decision yet, there might have some opportunities to get more profits, but there are also under some risks of losing money. Therefore, investors should hold what they have and keep their eyes on the change of MSFT's stock value.

Figure 4.3.3 General Motor's MACD Chart from July 18th to 20th in 2018

General Motor's MACD chart shows there is a decreasing tendency of the gap between 26-week EMA line and 12-week EMA line. Since that, investors should sell GM's stock as soon as possible.

4.4 Week Three Simulation

Until July 29 in 2018, the third week of stimulator is ended. According to the data on Investopedia.com, the largest profit value is from BAC's stocks, which is $1333.12. The result is same as the predication from last week's stimulator. Facebook's 12-week EMA line, which also called DIF line, is crossing 26-week EMA line, which called DEA line, and keep heading down. Even though these two lines is above the zero line, it is still a sign of falling of stock price. Therefore, investors sold all FB's stocks. GM's DIF line had the potential to crossing DEA line and heading up, it is a signal of increasing of stock price. However, after few days, the price GM's stock is keeping falling down. Therefore, Investors decided to sell all GM's stocks. AMZN's DIF line is crossing DEA line and

heading down, therefore, investors sold all of AMZN's stocks. Surprisingly, both DEA and DIF line of BAC is above zero line and without any tendency to crossing each other, so buying BAC's stocks was a wise decision. Table 4.4.1. shows the summary of the transactions of week 3. Figure 4.4.1., Figure 4.4.2. and Figure 4.4.3. show the MACD chart of FB, MSFT and GM from July 20th to July 27th.

Date	Symbol	Buy/Sell	Shares	Price	Net Cost/Proceeds	Profits/Loss	Total Cash	Total Profits
7/23/2018	FB	Sell	1224	$210.23	$257,321.52	$236,856.34	$257,301.53	$494,157.87
7/23/2018	AMZN	Sell	130	$1840.6	$239,278.00	$259,179.31	$234,463.61	$493,642.96
7/23/2018	BAC	Buy	4166	$30.74	$128,062.84	$365,723.65	$128,082.83	$493,806.48
7/24/2018	GM	Sell	3144	$39.87	$125,351.28	$366,111.63	$125,331.29	$491,442.92
7/24/2018	MSFT	Buy	1220	$108.18	$131,979.60	$359,613.53	$131,999.59	$491,613.12
7/25/2018	MSFT	Sell	1225	$107.96	$132,251.00	$358,031.90	$132,224.89	$490,256.79

Table 4.4.1. The Summary of the Transactions of Week 3

Figure 4.4.1. Facebook's MACD Chart from July 20th to 27th in 2018

As the chart shows, DIF line is under DEA line and DIF line keep heading down. This tendency indicates that the stock price of Facebook will not increase in the next few days. Therefore, investors should not buy any stocks of Facebook.

Figure 4.4.2. Microsoft's MACD Chart from July 20th to 27th in 2018

As the chart shows above, even though the DIF line above the DEA line, but DIF line is heading down. This indicates that the price of MSFT's stock may decrease. Investors should not buy any stocks of MSFT. If they hold some MSFT's stocks, they should sell them as soon as possible.

Figure 4.4.3. General Motor's MACD Chart from July 20th to 27th in 2018

As the MACD chart of GM shows above, DIF line is under DEA line and DIF line do not have any tendency to heading up. Therefore, the price of GM's stock will decrease in next few days. Investors should not purchase any GM's stock and sold the GM's stocks they have now as soon as possible.

4.5 Week Four Simulation

Until August 5th in 2018, the fourth week of stimulation is ended. According to the data on Investopedia.com, the profit maker is still BAC's stock which earned $3207.82 in last market period. Each stocks' performance is exactly same as what was show in last week's report. According to last week's predication, the value FB's stock would not increase; the price of MSFT's stock would be tending to decrease; the value of GM's stock is tending to be lower than before; the price of AMZN is tending to fall; NKE's market is still in a downturn period. Therefore, investors should not to take the risk to make any transaction last week. All they need is keep BAC's stocks in their hands. Figure 4.5.1.,

Figure 4.5.2. and Figure 4.5.3. show the MACD chart of FB, MSFT and GM from July 27th to August 3rd.

Figure 4.5.1. General Motors MACD Chart from July 30th to August 3rd in 2018

According to the MACD chart of GM, the DIF line has the tendency to crossing over DEA line and keep heading up. This is a sign of increasing of GM's stock's value. But it is not a good decision to purchase any GM's stock now. Investors could keep eyes on it. Once DIF line crossing DEA line, they could purchase GM's stocks to make money.

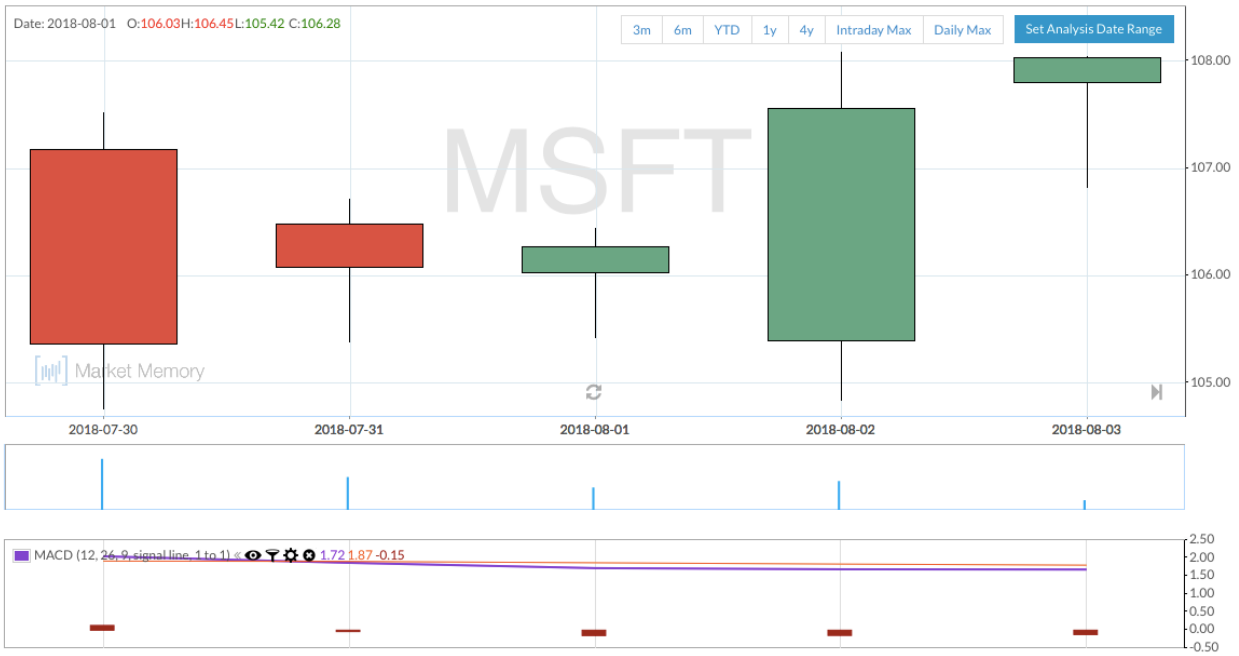

Figure 4.5.2. Microsoft Inc. MACD Chart from July 30th to August 3rd in 2018

According to the MACD chart of MSFT, the DEA line is above DIF line currently. Which means that the value of MSFT's stock is decreasing currently. Therefore, investors should not consider about purchasing MSFT's stock yet.

Figure 4.5.3. Facebook MACD Chart from July 30th to August 3rd in 2018

According to the MACD chart of FB, the DEA line is above DIF line currently. Which means that the value of FB's stock is decreasing currently. Therefore, investors should not consider about purchasing FB's stock yet.

Chapter 5. Analysis and Comparison

We tested two trading strategies in this four-week simulation: swing trading strategy combined with news trading strategy, and day trading strategy. Day trading had been more successful and gained significant profits while swing trading and news trading just got a little profit. Their end balances were $546,862.80, and $510,670.94 respectively. This resulted in a return on investment of 9.37% for Day Trading, and 2.13% for Swing Trading and News Trading. The return from day trading is very significant for such a short period of time. Comparatively, swing and news trading is not as effective as day trading.

The trading results are realistic and fair to analyse and compare because my stock portfolio is diversified. In detail, the three companies we invested, by using each trading strategy, fall into the similar industry sectors. In total, three pairs of companies were selected. Three of them are assigned to swing and news trading and the other three are to day trading.

Figure 5.1 presents the weekly total value differences between these two trading methods. According to the chart, day trading has a sudden increase in the last two weeks. The trend line for day trading matches with a linear distribution with an equation:

$$Y = 13811X – 461837, \quad (5)$$

However, the trend line of swing trading strategy is not so optimistic. The slope of the trend line is relatively small, and it matches a linear distribution with an equation:

$$Y = 2740.1X + 494233, \quad (6)$$

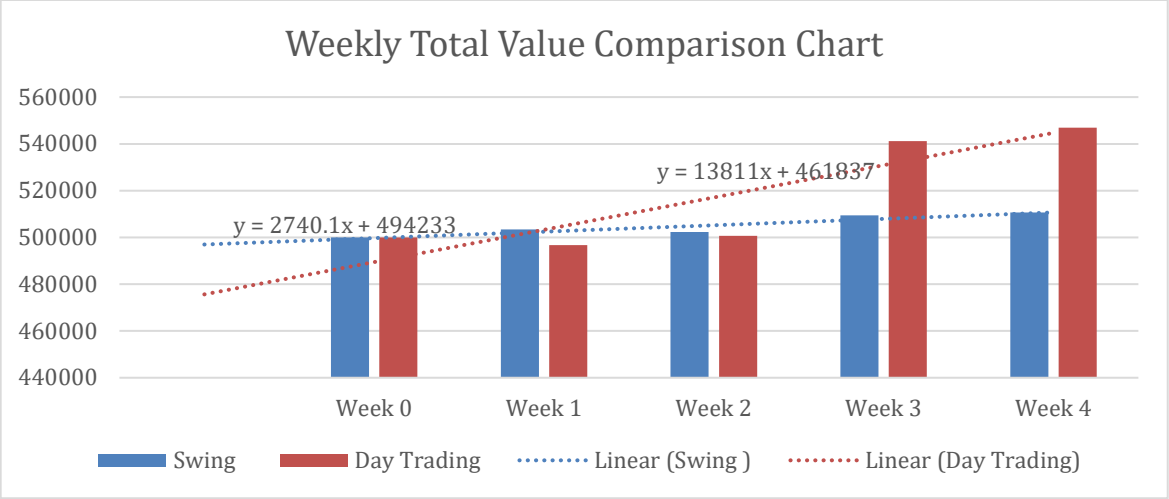

Figure 5.1 Weekly Total Value Comparison Chart with Linear Trend Lines

Figure 5.2 shows the weekly total value differences between these two trading methods and their trend lines by the polynomial distribution. According to the lines, we can know that the distribution of swing trading is nearly to linear distribution. Whereas, the trend of day trading can be described as polynomial distribution, which expressed as an equation of $Y = 3894.9X^2 – 17348X + 516365$.

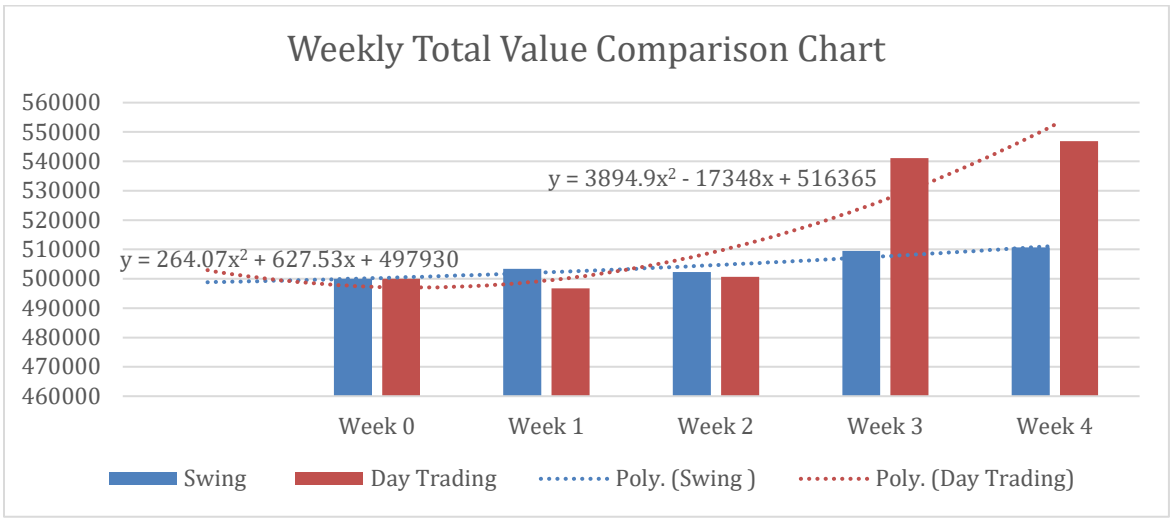

Figure 5.2 Weekly Total Value Comparison Chart with Polynomial Trend Lines

Figure 5.3 shows the weekly profit differences between these two trading methods and their trend lines by the linear distribution. Obviously, the slope of the line of day trading is much larger than that of swing trading.

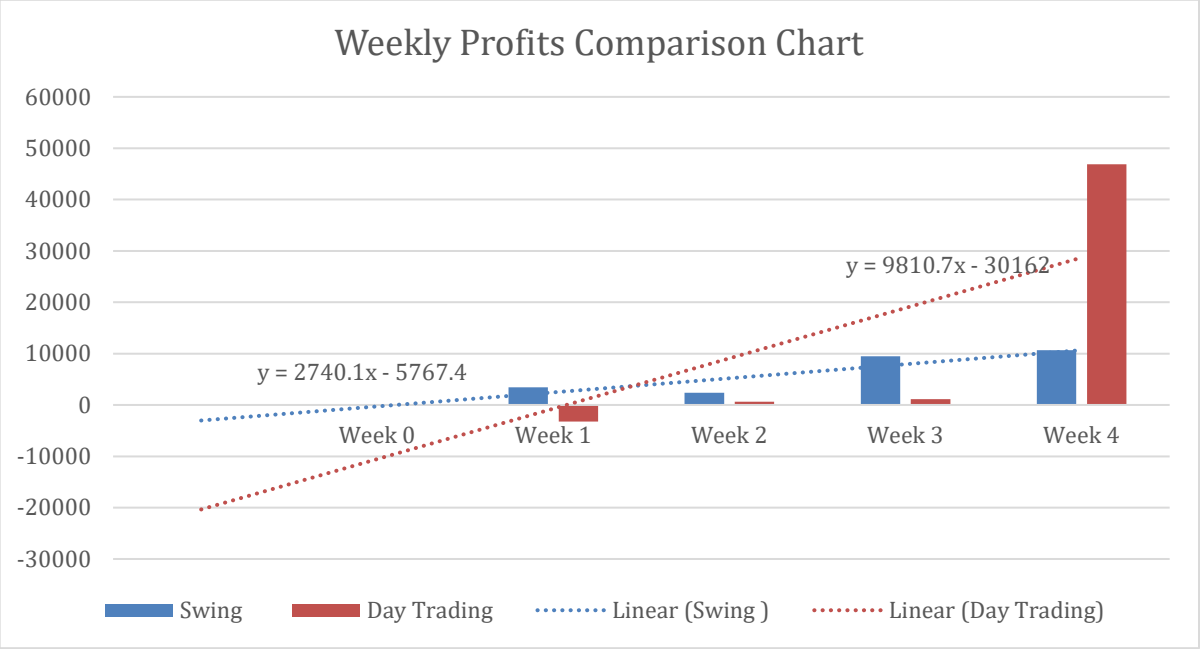

Figure 5.3 Weekly Profits Comparison Chart with Linear Trend Lines

Chapter 6. Conclusion

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

First, we aimed to gain some basic understanding of the fundamental principles governing the stock market. From the project, we achieved my first goal, by gaining experience in understanding and interpreting the behavior of the stock market. Our second goal was to learn how to analyze data. By experimenting with technical and swing trading, we acquired the basic skills to analyze stocks using a variety of different tools and techniques. Our third objective was to relate current events to stock price trends. During the project, we 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 we have learned from this project is very valuable and could be extremely beneficial to our financial investments in the future. This project equipped us with the basic techniques and knowledge of participating in the American stock market.

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