Stock Market Simulation

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Submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

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for the Degree of Bachelor of Science

By

Dan Mao

Hanyi Jiang

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Approved by Professor Dalin Tang, Project Advisor
Abstract

This IQP project is an eight-week stock market simulation research. The goal of the study is to gain experience of trading stocks through a real-time simulation using MarketWatch. Two simulations were performed: one focusing on using traditional technical analysis to trade, and the other using the fundamental analysis as a complement for advanced technical analysis. Both simulations result in a loss (5.6034% and 3.5255% respectively), mainly because of inadequate risk management and unsuccessful loss control. The experience will be very useful for the operators’ future investment in real life.
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Chapter 1: Introduction

The purpose of the project is to gain some basic experiences of investing in the stock market by doing a stock market simulation. We learn how to analyze data and how to use different trading methods through stock market simulations. The real state of the stock market is related to the stock simulation in the projects. We went over the history of the stock market, including the background information, important index and factors, past researchers, and historical crashes. The stock simulations are focusing on the American stock market. We decide to choose ten distinct stocks and use two ways to analyze the stock market. The simulation project will last for 13 weeks, and 8 out of 13 will be used to get the data from the current stock market. There are two simulations, one focus on using traditional technical analysis to trade, the other one uses the fundamental analysis as a complement for technical analysis to trade. Each of the simulations will start with the same condition: a $100,000 margin account. At the end of the project, we are expected to gain a deep understanding of stock trading and prepare for the real stock trade.

1.1 History of the Stock Market

The stock market existed until the 1500s. Before the real stocks market formulated, partners unofficially produce their incomes similar to what stocks do. The Venetians were the first to start exchanging securities from the government in the 1300s. They provided various information on different issues for sale and meet with different people who have a trend to exchange much like breakers do in the stock market (Beattie, 2017, para.4-5).

The first stock exchange can trace back to Antwerp in 1531. Belgium founded the exchange to provide a place where brokers and investors can meet and resolve debt issues not only for business and government but also for individuals. (Beattie, 2017, para.5)
During the 1600s, Imperialist countries founded the joint company to make profits through trading between East India and Asia. Barbary pirates, weather, and poor navigation result in the high risk of sea voyages. Shipowners had spent long practice looking for investors who can put up money for the voyages. If the voyages are successful, the investors will get returns of certain percentage; if not, those investors had to bear the risk. Investors can invest in several different ventures at the same time to spread the risk. (Beattie, 2017, para.6-7)

Previous stocks, like those in East India companies, are issued by the paper that holders can sell to other investors. However, there was no stock exchange exists, and the investors have to track breakers to carry out the trades which were usually trade in coffee shops (Beattie, 2017, para.9). In 1773, the first official stock exchange was established in London, 19 years earlier than the New York Stock Exchange. New York Stock Exchange was not the first official stock exchange in America. But it was the most powerful one, which then snowballed and became one of the most important stock exchange market all over the world. (Beattie, 2017, para.13)

1.2 Factors of Stock Market grown

The stock market is unstable and can be quite volatile. The unstable situation is caused by several factors that may influence not only the stock price but also the stock market (Pettinger, 2017, para.1). In general, there are seven main underlying factors: Economic growth, Interest rates, Stability, Confidence and expectations, Bandwagon effect, Related markets, and Price to earnings ratios.

(i). Economic growth is a key factor that affects the stock market. The higher economic growth will make more profits for companies, because of the more demand for goods and services. This factor will help companies to increase share price by increasing the dividends. (Pettinger, 2017, para.3)
(ii). Interest rate is another factor which has effects on the stock market. If the interest rate of shares is low, these shares will attract more attention from investors for two reasons. The first reason is that the low-interest rate plays a very important role in boosting economic growth which may make the shares more profitable. Another reason is that shares with low-interest rate are more attractive than saving money in the band or buying bonds. If the profit from the bond is low, investors are encouraged to purchase shares. (Pettinger, 2017, para.4)

(iii). Stability is the most important factor that can come from different areas. If a stock has the possibility to be threatened by economic instability or political instability, investors may refuse to purchase the stock. The most common examples of economic instabilities are terrorist and increasing oil price. (Pettinger, 2017, para.5)

(iv). The investor’s confidence and expectation will influence their actions. If they get a positive signal and feel confident, they will buy more shares; if they find the negative signal, they will sell the shares. Usually, people believe that there will have a profit after the depth of the recession. Even though the situation of the stock market remains poor, investors try to predict the future and buy more shares. (Pettinger, 2017, para.6)

(v). The stock market usually be influenced by the bandwagon effect. For example, in 1987, a little bad news made the whole stock market to fall by 25%. The decreasing of the stock market is sometimes full of mysteries. When the price decreasing, people always choose to sell their shares. (Pettinger, 2017, para.7)

(vi). People have different choices, such as shares, government bonds, and commodities. If people think that the bond is not stable and have the trend to fall, they will invest more on share. (Pettinger, 2017, para.8)
1.3 Index of the Stock Market

The stock market index is used to measure the value of a set of stocks. They are powerful indicators not only for some country-specific economics but also for global economics. Stock market indicators can be classified in several ways, such as different regions and different countries. (Banton, 2019, para.1) The example of global market indices is the MSCI World and the S&P Global 100, which include the stocks from many regions. Different countries have their national indexes to evaluate the performances of the specific market within the region, such as American S&P 500, the British FTSE 100, Nikkei 225 in Japan, and NIFTY 50 in India. Also, there is some regional stock market index, such as the FTSE Developed Asia Pacific Index. It can also base on the exchange, such as NASDAQ. (Wikipedia, 2019, para.3-5)

This project will focus on the American stock market. Within the United States, there are many indices which contradict in different industries. The significant indices in America are the S&P 500, the Dow Jones Industrial Average, the Nasdaq Composite Index, the Wilshire 5000, and the Russell 2000 Index. This section mainly introduces these indices.

1.3.1 Dow Jones Industrial Average (DJIA)

The Dow Jones Industrial Average is the index that tracks 30 most significant and influential US. publicly trading companies (The Motley Fool, 2018, para.1). DJIA was created in 1896 and named after Charles Dow and Edward Jones (Ganti, 2019, para.1). It is one of the oldest, most-watched indices over the world. “The market is up today” is always refer to DJIA. DJIA
includes many famous companies, such as Microsoft Corporation. (Ganti, 2019, para.2) Table 1.1 shows 30 major companies included in DJIA.

**Table 1.1 Major companies included in the Dow Jones Industrial Average Index**

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Ticker</th>
<th>Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>The 3M Company</td>
<td>MMM</td>
<td>NYSE</td>
</tr>
<tr>
<td>The American Express Company</td>
<td>AXP</td>
<td>NYSE</td>
</tr>
<tr>
<td>Apple Inc.</td>
<td>AAPL</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>The Boeing Company</td>
<td>BA</td>
<td>NYSE</td>
</tr>
<tr>
<td>Caterpillar Inc.</td>
<td>CAT</td>
<td>NYSE</td>
</tr>
<tr>
<td>Chevron Corporation</td>
<td>CVX</td>
<td>NYSE</td>
</tr>
<tr>
<td>Cisco Systems, Inc.</td>
<td>CSCO</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>The Coca-Cola Company</td>
<td>KO</td>
<td>NYSE</td>
</tr>
<tr>
<td>DowDuPont Inc.</td>
<td>DWDP</td>
<td>NYSE</td>
</tr>
<tr>
<td>Exxon Mobil Corporation</td>
<td>XOM</td>
<td>NYSE</td>
</tr>
<tr>
<td>The Goldman Sachs Group, Inc.</td>
<td>GS</td>
<td>NYSE</td>
</tr>
<tr>
<td>The Home Depot Inc.</td>
<td>HD</td>
<td>NYSE</td>
</tr>
<tr>
<td>International Business Machines Corporation</td>
<td>IBM</td>
<td>NYSE</td>
</tr>
<tr>
<td>Intel Corporation</td>
<td>INTC</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>JNJ</td>
<td>NYSE</td>
</tr>
<tr>
<td>JPMorgan Chase &amp; Co.</td>
<td>JPM</td>
<td>NYSE</td>
</tr>
<tr>
<td>McDonald’s Corporation</td>
<td>MCD</td>
<td>NYSE</td>
</tr>
<tr>
<td>Merck &amp; Company, Inc.</td>
<td>MRK</td>
<td>NYSE</td>
</tr>
<tr>
<td>Microsoft Corporation</td>
<td>MSFT</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>Nike, Inc.</td>
<td>NKE</td>
<td>NYSE</td>
</tr>
<tr>
<td>Pfizer Inc.</td>
<td>PFE</td>
<td>NYSE</td>
</tr>
<tr>
<td>Proctor &amp; Gamble Co.</td>
<td>PG</td>
<td>NYSE</td>
</tr>
<tr>
<td>The Travelers Companies, Inc.</td>
<td>TRV</td>
<td>NYSE</td>
</tr>
<tr>
<td>UnitedHealth Group, Inc.</td>
<td>UNH</td>
<td>NYSE</td>
</tr>
<tr>
<td>United Technologies Corporation</td>
<td>UTX</td>
<td>NYSE</td>
</tr>
<tr>
<td>Verizon Communications Inc.</td>
<td>VZ</td>
<td>NYSE</td>
</tr>
<tr>
<td>Visa Inc.</td>
<td>V</td>
<td>NYSE</td>
</tr>
<tr>
<td>Walmart Inc.</td>
<td>WMT</td>
<td>NYSE</td>
</tr>
<tr>
<td>Walgreens Boots Alliance, Inc.</td>
<td>WBA</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>The Walt Disney Company</td>
<td>DIS</td>
<td>NYSE</td>
</tr>
</tbody>
</table>

The general trend of development is increasing since it was first published. In history, there are several significant drops happened in 1933, 1987, 2001, and 2009. In 2018, the index first closed above $25,000 and reached the highest point in history, which is $26,743.50. The current price of DJIA as May 07, 2019 is $25,965.09. The market summary of the Dow Jones Industrial Average is shown in Figure 1.1.
1.3.2 Nasdaq Composite Index

The Nasdaq Composite Index is based on the exchange on which technology stocks are purchased (Banton, 2019, para.10). It is the market capitalization-weighted index of the stocks listed on the Nasdaq stock exchange, which included over 3300 equities (Chen, 2018a, para.1). The current value of the market is $7910.60 on May 09, 2019. There is a slightly decreasing compared to the previous value and increased by 19.22% in one year. The general development trend is rising since it was first published. The stock market summary of Nasdaq is shown in Figure 1.2.

Figure 1.1 Market Summary of DJIA from 1927 to 2019 from macrotrends

1.3.2 Nasdaq Composite Index

The Nasdaq Composite Index is based on the exchange on which technology stocks are purchased (Banton, 2019, para.10). It is the market capitalization-weighted index of the stocks listed on the Nasdaq stock exchange, which included over 3300 equities (Chen, 2018a, para.1). The current value of the market is $7910.60 on May 09, 2019. There is a slightly decreasing compared to the previous value and increased by 19.22% in one year. The general development trend is rising since it was first published. The stock market summary of Nasdaq is shown in Figure 1.2.
There is another index named the Nasdaq 100 Index, which is different from the Nasdaq Composite Index. The Nasdaq 100 Index shows the 100 most massive, active American companies listed on Nasdaq exchange. It includes many companies from different industries except finance. (Chen, 2018b, para.1) There are 104 companies involved in the Nasdaq 100 Index. Table 1.2 shows the 104 companies included in the Nasdaq 100.

Figure 1.2 Nasdaq Market Summary from 1973 to 2019 from TradingView
The Standard & Poor's 500 Index is commonly known as the S&P 500. It is the index to weight the market capitalization of the 500 largest publicly trading companies in the United States. It is considered as the best gauge of large-cap American equities. (Kenton & Murphy, 2019, para.1) It represents over 80% of the total value of the whole stock market in the United States (Banton, 2019, para.5).

Compared to the Dow Jones Industrial Average, institutional investors prefer the S&P 500 due to the depth and breadth of this index. They believe that the S&P 500 index is more representative than the DJIA because it includes more companies from various sectors. The

Table 1.1 Companies included in the Nasdaq 100 Index

<table>
<thead>
<tr>
<th>Company</th>
<th>Ticker</th>
<th>Company2</th>
<th>Ticker3</th>
<th>Company4</th>
<th>Ticker4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activision Blizzard</td>
<td>ATVI</td>
<td>Honeywell, Inc.</td>
<td>HSIC</td>
<td>Fastenal Company</td>
<td>FAST</td>
</tr>
<tr>
<td>Adobe Inc.</td>
<td>ADBE</td>
<td>IDEXX Laboratories, Inc.</td>
<td>IDXX</td>
<td>Nevro, Inc.</td>
<td>FSV</td>
</tr>
<tr>
<td>Advanced Micro Devices</td>
<td>AMD</td>
<td>Illumina, Inc.</td>
<td>ILMN</td>
<td>Fox Corporation</td>
<td>FOX</td>
</tr>
<tr>
<td>Allegra Pharmaceuticals</td>
<td>ALGN</td>
<td>Incyte Corporation</td>
<td>INCY</td>
<td>Fox Corporation</td>
<td>FOXA</td>
</tr>
<tr>
<td>Align Technology, Inc.</td>
<td>ALGN</td>
<td>Intel Corporation</td>
<td>INTC</td>
<td>Gilead Sciences, Inc.</td>
<td>GILD</td>
</tr>
<tr>
<td>Alphabet Inc.</td>
<td>GOOGL</td>
<td>Intuitive Surgical Inc.</td>
<td>ISRG</td>
<td>Walgreens Boots Alliance, Inc.</td>
<td>WBA</td>
</tr>
<tr>
<td>Amazon.com, Inc.</td>
<td>AMZN</td>
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1.3.3 Standard & Poor's 500 Index (S&P 500)

The Standard & Poor's 500 Index is commonly known as the S&P 500. It is the index to weight the market capitalization of the 500 largest publicly trading companies in the United States. It is considered as the best gauge of large-cap American equities. (Kenton & Murphy, 2019, para.1) It represents over 80% of the total value of the whole stock market in the United States (Banton, 2019, para.5).
Standard & Poor's 500 Index provides a higher percentage allocation for those companies who have the largest market capitalizations through a market capitalization weighting method while the DJIA only provides higher index weighting for higher-stock-pricing companies. (Kenton & Murphy, 2019, para.7-8)

The S&P 500 index was first officially published by Standard & Poor on March 4, 1957. In 1966, this index was acquired by McGraw-Hill. It is now owned by the S&P Dow Jones Indices which is a joint venture. Until now, over one million indices has been published by the owner. (Amadeo, 2018, para.12) In 2017, the 10 largest companies which have weighted market cap in the Standard & Poor's 500 Index were Apple; Microsoft; Amazon; Berkshire Hathaway B; Facebook; JP Morgan Chase; Johnson & Johnson; Exxon Mobil; Alphabet C, formerly Google; and Alphabet A (Amadeo, 2018, para.7).

The market value of the S&P 500 is $2870.72 on May 9, 2019. It increased by 6.41% since last year and increased by 11.94% in ten years. There was a significant decreasing of 20.5% on October 19, 1987, due to the Black Monday; the most significant gain of 11.6% existed on October 13, 2008. Also, there was a new record high appeared on March 28, 2013; and it first closed at a value higher than 2000 on August 26, 2014. Another tremendous close record appeared on September 21, 2018. (Amadeo, 2018, para.13) The S&P 500 index market summary of recent ten years is shown in Figure 1.3, and the whole market summary is shown in Figure 1.4.
If the stock in the S&P 500 index is overvalued, there will exist a limitation of the Standard & Poor's 500 Index. If the overvalued stock weighted heavily in the index, the whole index would typically inflate the overall price and value. (Kenton & Murphy, 2019, para.18)

1.3.4 Wilshire 5000 Total Market Index (TMWX)

The Wilshire 5000 Total Market Index is a market capitalization-weighted index composed of over 6,700 listed companies. Those companies included in this index must fulfill three requirements. The first is that these companies must headquarter in the United States. Secondly, they have to be traded actively on American stock exchange. Thirdly, the information of the stock should be widely published. TMWX is also one of the most extensive indexes like the previous...
indexes. The Wilshire Associates first published the Wilshire 5000 Total Market Index in 1974 within originally 5000 stock. In April 2004, the index was renamed as Dow Jones Wilshire 5000 when Dow Jones & Company managed it, but it returned to the previous company in 2009. (Kenton, 2018, para.1-4)

When the index was first published, the value was 1404.60 points with a total amount of $1,404.596 billion on December 31, 1980. The value of the index increased over ten times in no more than 20 years and reached 14,751.64 points on March 24, 2000. There was the highest point in the history on October 9, 2007, right before the Great Recession on October 8, 2007. Several milestones of high point exist on February 28, 2014; March 4, 2014; and July 1, 2014. (Kenton, 2018, para.5) The current value of TMWX is $29694.40 on May 9, 2019. The whole stock market summary of the Wilshire 5000 Total Market Index is shown in Figure 1.5.

![Figure 1.5 Market Summary of TMWX from first published from MarketWatch](image)

1.3.5 Russell 2000 Index

The Russell 2000 Index measures the value of 2000 smallest-cap U.S. companies belongs to the Russell 3000 Index (Chen, 2019, para.1). In 1984, it was first established by the Frank Russell Company. The Russell 2000 Index is two-thirds of the Russell 3000 Index and represented 98% of the stock market which is investable. (Chen, 2019, para.4) It is the most common quotes used to measure the value of small-cap to mid-cap stocks and represent 8 percent of the
capitalization of the Russell 3000 Index (Chen, 2019, para.6). Until December 31, 2017, the average value of this index was $2.4 billion, and the median market cap became $861 million. The current value of the Russell 2000 Index is $1569.03 on May 10, 2019. It decreased by 2.35% since last year and has increased by 16.35% at the beginning of 2019. The market summary of the Russell 2000 Index is shown in Figure 1.6 below.

![Market Summary of Russell 2000 from 1987 to 2019 from MarketWatch](image)

Apart from the Russell 2000 Index, there is another index called the Russell 1000 Index, which is the component of smallest 1000 companies listed in the Russell 2000 Index (Chen, 2019, para.8).

### 1.4 Past Researches on Stock Simulation

#### 1.4.1 researches related to WPI

When we search the keywords, stock simulation, in the George C. Gordon Library, we can get 208,994 results. There are 135 researched found in the database of the WPI library, which is related to stock stimulation. Most of the researchers aim to gain personal experience of stock trading through stock stimulation at a particular time through conducting several stock trading strategies. Most of the researches are related to the Interactive Qualifying Project. The stock stimulation is always between 4 to 10 weeks through the previous projects.
One of the projects was using the primary resources to conduct a stock strategy and test the investment method of the current market in five weeks. In the project, Craves and Cirillo use two different portfolios to help understand the investment strategies. They choose very different stocks and generated the profits in only five weeks. (Craves, C. F. & Cirillo, M. D., 2008)

Another project chose five distinct industries from the service sectors and began at $100,000. The time they trade for the project was between a Late Recovery and Early Recession of the American stock market. The total amount of $6774.10 was generated by the researchers at the end of the five-week project. (Burnell, N.G., 2016)

The two examples of projects done by WPI students are all aimed to gain experience. The chosen periods are very different, but they all made profits. They cannot make an exact comparison between the two projects, but the information we can get is that the stock market is stable and unpredictable. Even though the state of the stock market is depression, we have chances to make profits.

1.4.2 researches unrelated to WPI

There are many research tools provided for not just stock simulations, but also other simulation related to the stock market. Many stocks simulation research can be found online. A majority of various ways are used to analyze the stock market and make some predictions. Those researches are always focused on distinct regions.

One of the researched published in 2017 talked about the effects of stock news on the stock market focused on stock news sentiment. It predicts the possible news related to the stock market that may affect the whole market stock. The researchers analyzed these news sentiments and established the algorithm to find the sentiments through the data provided by the news. (Bharathi, 2017)
There is also research specific on the stock market of one country. One example of research published in 2019 specified on the stock market in India. The global stock market has different participating, ranging from naive investors to fund managers. The ARIMA model was used in the research the conduct the NSE in India. The whole research focused on the volatility of the stock market in India and aimed to solve the problem of forecast stock volatility. (Wadhawan, 2019)

1.5 Stock Market Crashes in History

Stock market crashes are rapid and unprepared. They are caused by many reasons, such as essential catastrophic events, economic crisis, and the side effect of the bubble economy. (Chen, 2019, para.1) Another important reason for the stock market crash is mass panic. The examples of the well-known stock market crash happened in 1929 and 1987. These stock market crashes occurred due to the Great Depression, and Black Monday resulted from the decline of economy and panic selling. (Chen, 2019, para.3)

1.5.1 Great Depression in 1929

The stock market crash occurred on October 29, 1929, started on "Black Tuesday" which hit Wall Street through trading near 16 million shares on the New York Stock Exchange, lost billions of dollars and affected thousands of investors. After the Black Tuesday, America and other industrialized countries spiraled downward into the deepest and longest-lasting economic depression, the Great Depression, for over ten years. (History.com, 2019, para.1)

At the beginning of the 1920s, the stock price of the U.S. stock market underwent rapidly and reaching the peak in August 1929 after the speculation of investors. Meanwhile, production had declined, and unemployment had increased. The whole stock market exceeds its real value. (2019, para.2) The price started to decline in September and October 1929 and caused the "Black Thursday" on October 24. Although there is sight recovery on the coming Friday, it became more
serious on Monday (October 28, 1929). Then, the stock market collapsed completely on Tuesday (October 29, 1929). (2019, para.3) After this Tuesday, the price of the stock market begins to recover, but the whole market is not as positive as it should be. The United States slumped into the Great Depression. Until 1932, the total value of the whole market is only 20% of that in the summer of 1929. Half of the banks in America failed, and nearly 15 million people lost their jobs, which occupied 30 percent of the whole workforce. Until 1939, the economy began to recover after the Second World War. (2019, para.4-5)

1.5.2 Black Monday in 1987

This stock market is known as "Black Monday." Before the decline of the whole market, the Dow Jones Industrial Average (DJIA) increased more than tripled in 5 years. A rapid downturn happened in late October 1987, which decreased by nearly 22% on October 22, 1987. The Federal Reserve and U.S. stock exchanges intervened to control the damage of the stock market to slow down the decline in the future. Even though it was a U.S. phenomenon, 19 out of the 20 largest stock market in the world were affected and lost nearly 20%. However, only the DJIA declined 22% on the Black Monday, and the decline is well limited on the coming Tuesday. The stock market recovery rapidly. (Kenton, 2019, para.1-3)

1.5.3 Fall of Market in 2008 Fall

Another major stock market crash occurred in 2008, start in the real estate market. The effect of this crash is severe; even today, the stock market is affected by the depression. (Chen, 2019, para.) The major economic markets lost over 30% of their initial value. The fall in 2008 became one of the most horrible periods in the history of the United States. The crashed mainly resulted from the subprime borrowing increased in 1999 and boomed in 2008.
Chapter 2: Methodology

This chapter mainly describes the methods that we will use in the simulations. First is the stock simulation engine that will be applied in the whole project. Then we will apply two investment strategies: Technical trading and Swing Trading. Every week, the fundamental analysis is noted as well as the technical analysis. After the eight-week simulation project, we will compare the two trading strategies.

2.1 Stock Simulation Engine

Stock simulation trading allows people to trade stock without risking any money. The simulation market is the same as the real stock market, and the only difference is the fake money that people use in stock simulation engine (Berge, 2016, para.5). It is very efficient to learn the process of stock exchange through the simulated order (Berge, 2016, para.6). There are many stock trading platforms provided the stock market simulation engine, such as Optionsxpress, TD Ameritrade, Scottrade, Trademonster, and Interactive Brokers. They all have pros and cons. Most of the stock simulation engines in the stock market are free. When people first register the brokers, they will get a free account with fake money. (Berge, 2016) Some simulation engine will provide more choice while some will give the reward for the people who perform well in the simulation engine.

For this project, we will use the Virtual Stock Exchange (VSE) from Market Watch, where 39,969 games are performed now to perform the stock simulation. Market Watch uses the real-time market data for simulated trading and can experience simulated trading across any devices. Investors can talk strategies with each other in the group of the game. The whole simulation market is customized; the group can be public and private. We set the initial virtual budget at $100,000. Figure 2.1 shows the personal profile of the stock market simulation.
On the overview page of the stock game simulator, there is a search bar for people to search what they want to trade. The stock can be found and tracked through this bar and added to the trade list through searching the unique stock symbol. The example of the searching bar is shown in Figure 2.2.

Once the users decided which stock to purchase, they will know how much for one share and choose how many shares they want. The order summary will show the detail of your preferred stocks. For example, if we're going to trade the S&P 500, we need to search the unique symbol which is SPYX and choose a trade. The detail of the S&P 500 will be found in summary. The price per share of SPYX is $68.52 on May 24, 2019. Also, for each trade, we need to pay $10 for commission. Figure 2.3 shows the example of the summary of trade order.
After trading, the summary of trading can be found on in ‘Your Portfolio’ which will show the net assets of your account, the daily changes, total gains, and remaining money that can be used for purchase. This can easily help new investors to track their trade history and their gain or loss. Since we have not started to trade any stock, the summary of trading (Figure 2.1) only have the original record when we first created the game.

2.2 Investment Strategy

Two investment strategy will be applied in the traditional stock market simulation: technical trading and swing trading. Also, technical trading will be related to the code in simulation 2.
2.2.1 Technical Trading

Technical trading is a trading discipline used to evaluating investment and identify opportunities for trading (Hayes, 2019, para.1). It is not only limited to trading, but also a broader style. Usually, the technician will use the historical pattern to predict the future pattern of stocks. It is more like the process for meteorologists to predict the weather. (Palmer, 2019, para.5) Technical trading can be employed on any security with historical data, including stocks, products, futures, and others (Hayes, 2019, para.2).

Technical trading begins with the Dows Theory introduced by Charles Dow in the late 1800s (Hayes, 2019, para.3). The theory has two key points. First, the stock market is efficient, and the value represents the essential factor that influences the price. Secondly, the price of the stock is not random, and the movement pattern will repeat over time. (Hayes, 2019, para.6)

Dead cat bounce is one of the common terms used in technical trading. Usually, when the price decreased in a down market, there will follow with an increase in price. Buyers believed the price of the stock is under looked or the price is oversold. However, if the market continues to decline, temporary buying is usually called the dead cat bounce. When we encounter Doji pattern, which means open and close prices are similar shows the undecidable of the stock market. The trend of figures can be analyzed through ADX, ADXR, CCI, MACD, and so on. More details about the essential terms of technical trading will be explained in section 2.3.

2.2.2 Swing Trading

Swing trading is defined as fundamental trading. In swing trading, the positions will be held longer than one day. Usually, most fundamentalists will apply swing trading, because they believe that the change of companies requires several days to result in the sufficient movement of prices to get the profits. However, this description is simplified. It is actually between day trending
and trend trading. The first important factor of swing trading is choosing the right stock, such as large-cap stocks. (Hall, 2019, para.1-2)

Swing traders prefer to select chart patterns of multi-days. The typical pattern, including moving average crossovers, flags, triangles, and others. (Mitchell, 2019, para.12) Swing trading shares many terms with technical trading. Simple Moving Average (SMA) will be used in swing trading to bullish and bearish patterns. Exponential Moving Average (EMA) is the variation of SMA. It provides more straightforward and faster signals of entry and exit points than SMA. (Hall, 2019, para.7-8) By checking the lowest point, investors can control the loss when the market declines. By predicting the highest point, investors can determine a target of profits. (Mitchell, 2019, para.6) It can help traders to predict how to gain the maximum profit.

2.3 Technical Trading

Fundamental analysis and technical analysis are two common approaches toward stock market prediction. Different from the fundamental analysis, technical analysis focuses more on the price itself instead of the economic factors like fundamental analysis does. Technical analysts predict the price by following the reversal patterns and studying indicators and moving average lines. In recent years, as the deep learning models boomingly advance, some technicians tried to apply the deep learning model, for example, Long Short-Term Memory, with stock price prediction.

In this project, we decided to technical trading in two ways: predict by patterns and indicators; predict price through LSTM model.
2.3.1 Indicators

Financial Ratios:

Financial ratios are a group of factors help figures out a company’s financial performances. They include:

Leverage Ratios indicate how the company’s assets and business operations are financed. Two leverage ratios we are going to use are Debt-to-Assets Ratio (Total Debt / Total Assets), and Debt-to-Equity Ratio (Total Debt / Total Equity).

Liquidity Ratios gives a picture of the company’s short-term financial situation. We are going to use the current ratio (Current Assets/ Current Liabilities) in the following analysis.

Operational Ratios use turnover measures to the effectiveness of a company’s operation. It’s calculated by the sum of operating expenses and the cost of goods sold, over the net sale.

Profitability Ratios shows the return on sales and capital employed.

Solvency Ratios gives a picture of a company’s cash flow.

Moving Average Convergence/Divergence Indicator (MACD)

MACD is a momentum indicator that shows the relationship between two moving average. This indicator consists of a MACD line, a signal line, and a Histogram. The MACD line is calculated as a 12-day EMA minus 26-day EMA. The signal line is calculated as a 9-day EMA of the MACD line. The Histogram represents the difference between these two lines.

Moving average

Moving average helps determine the direction of the current trend of the market. It smooths the data in a period and allows us to find potential support and resistance levels. There are two common types of moving average, simple and exponential. A simple moving average (SMA) is calculated as an average over a time range. An exponential moving average (EMA) is a weighted
moving average that gives more weighting to the recent data. The EMA gives a quicker response to the last price change than the SMA.

To calculate the EMA, we need to get the SMA and the multiplier for the weighting coefficient, and finally generate the EMA based on that.

**Trend Line**

The trend line is one of the simplest indicators. A market can do three things: go up, go down, or go sideways. The trend line is the tool we use for identifying the trend direction. It is a straight line that connects a series of price points. The more it touches, the more convincible it is. As a general concept, it takes at least three points to determine a valid trend line.

To determine an upward trend line, we start at the lowest price as possible and extend it until it reaches three points without touching the pattern. Determine a downward trend line follows a similar procedure, but we start our trend line from the highest price point and extend the line through at least three high price points this time.

**Relative Strength Index (RSI)**

The RSI is a momentum oscillator that measures the strength and the speed of the market’s price movement by comparing the magnitude of recent gains to the magnitude of the recent losses. Normally, a 14-day period is used to produce this indicator, but it can be adjusted based on the sensitive level.

**2.3.2 Analyzing Through Code: LSTM Model**

LSTM stands for long short-term model, which is a machine learning commonly used to analyze consecutive data with a sophisticated, unrevealed correlation between each data point. It is developed on top of the structure of recurrent neural networks (RNN) with a more advanced design for each layer. We think LSTM will be suitable for time series, and our simulation as well,
And, we intend to train the model, so it gives us a simulation that’s correlated with real market data.

The general procedure we are going to follow is listed below:

1. Reading and analyzing data. (Pandas)
2. Normalizing the data. (SkLearn)
4. Creating a model (Keras)
5. Fine-tuning the model
6. Training, predicting, and visualizing the result.
Chapter 3: Trading

This chapter will include the process of simulated trading in two different ways. The first simulation uses the traditional strategies to trade stocks, and the second way uses code to analyze the historical data of the shares for trading combines with fundamental analysis. First, the companies selected for the stock market simulation project will be introduced in section 3.1. This chapter will also include the initial investment record of the two distinct simulations in section 3.2 and 3.3. There are eight weeks for stock market simulation. The Moving Average Convergence Divergence (MACD) chart will be represented every week, and the overall result to be concluded at the end of each section.

3.1 Company and ETF Selected

Ten stocks are chosen for the project. Four out of ten belong to ETF, and six out of ten are the shares belong to different companies. These six stocks come from a distinct region to make sure the stock market simulation is diversified. However, not all ten stocks will be purchased every week.

3.1.1 ETF: TVIX

TVIX stands for the stock that provides 2x inverse exposure to S&P in a short-term period. The period is usually near one month. It has good block liquidity and modest spread trades in huge volume.

Until May 31, 2019, the current stock price is $26.15. The general trend of the whole stock price is decreasing since it was first offered. It the chart is smooth. However, this month, the SMA(50) intersected several times with the stock price. These intersections may result from the things that happened to this stock. Some accidents may happen and make the increase in the stock price. The details of the MACD and SMA of TVIX in three months is shown in Figure 3.1.1.
3.1.2 ETF: TQQQ

TQQQ stands for the stock provides leveraged 3x inverse exposure to NASDAQ 100 for a single trading day. The exposure will be delivered on a period of one day. Trading cost is more important than the management cost here.

Until May 31, 2019, the current stock price is $51.28. The general trend of the whole stock price is increasing since it was first offered. Although, in this month, there is a slightly decreasing. The details of the MACD and SMA of TQQQ in three months is shown in Figure 3.1.2. Since the moving average is below the signal moving average in these days, there is a potential of reversal, and therefore TQQQ is chosen for the stock market simulation.
3.1.2 MACD and SMA Chart of TQQQ from MarketWatch

3.1.3 ETF: SQQQ

SQQQ stands for the stock provides 3x inverse exposure to NASDAQ 100 for a single trading day. It aims to provide exposure on a period of the single day rather than long-term holds.

Until May 30, 2019, the current stock price is $43.50. The general trend of the whole stock price is decreasing since it was first offered. In recent years, the price is developing steadily. However, in this month, there is a slightly increasing. So, we choose it as one of the stocks to watch. The details of the MACD and SMA of SQQQ in three months is shown in Figure 3.1.3.
3.1.4 ETF: UPRO

UPRO stands for the short-term instrument rather than a buy-and-hold ETF. It provides 3x inverse exposure in a one-day period. The total owning cost mainly depends on the liquidity rather than the management cost.

Until May 30, 2019, the current stock price is $45.40. Compared to the stock price in 2017, and the stock price in 2018, the stock price in 2019 is higher. The general trend of the stock price is increasing. So, we choose UPRO for the stock market simulation. The details of the MACD and SMA of UPRO in the recent year is shown in Figure 3.1.4. Since the moving average is below the signal moving average, there is a potential of reversal.
3.1.5 ETF: SPXS

Like UPRO, SPXS stands for the stock provides 3x inverse exposure to S&P 500 for a single trading day. SPXS is a little bit more expensive than its competitor, SPXU. It promises to offer -300% of returns in a period of one day.

Until May 29, 2019, the current stock price is $21.72. The general trend of the stock price is decreasing since the beginning of 2019. Since the SPXS stand for the decreasing ETF, we choose it as a part of the simulation. The details of the MACD and SMA of SPXS in the recent year is shown in Figure 3.1.5.
3.1.6 UBER (Uber Technologies Inc.)

Uber is a transportation company headquarters in San Francisco. This company mainly provides its transportation services online through the application as well as tracking their positions. It has over 785 operating bases all over the world. Uber application has already become one of the most famous transportation now.

According to the financial data from Market Watch, Uber Technologies Inc. Initial public stock offers on May 10, 2019, with $42.57 per share. Once it was published, it encountered a decreasing until $37.10 on May 13, 2019.

Until May 29, 2019, the current stock price is $39.50. The general trend of the stock is decreasing in the recent week. Since UBER is new stock, we choose it as a part of the simulation. The detail of the MACD and SMA is shown in Figure 3.1.6.
3.1.7 NFLX (Netflix)

Netflix was formed on August 29, 1997 and began to launch subscription service in 1999. It is an OTT service company engaging in providing online video for costumes from different countries. It also provides DVD rental service in the United States. Netflix already has 69.17 million subscribers all over the world.

According to the financial data from Market Watch, Netflix has a total revenue of 15.79 billion dollars and a net income of 1.21 billion dollars. Compared to the total revenue in 2017, which is 11.69 billion dollars and net income in 2017, which is 558.93 million dollars., there is an increase in profits. However, the stock has already decreased by 4.25% in recent three months.

Until May 29, 2019, the current stock price is $347.44. The simple moving average (SMA) is a trend to be smooth. Also, MACD is lower than signal MACD and historical MACD. The detail
of the MACD and SMA in recent three months is shown in Figure 3.1.7. As a result, there may exist a reversal of this stock. Thus, we chose NFLX for the stock market simulation.

![Figure 3.1.7 MACD and SMA Chart of NFLX from MarketWatch](image)

**Figure 3.1.7 MACD and SMA Chart of NFLX from MarketWatch**

### 3.1.8 DHR (Danaher Corporation)

Danaher Corporation is a Fortune 500 company committed to solving complex challenges for consumers and improving their quality of life. This company was listed as the 162nd on the Fortune 500 in 2018. It was first established in 1969 and engaged in industrial manufacturing, electronic measurement, environmental monitoring, and medical treatment.

According to the financial data from Market Watch, Danaher Corporation has a total revenue of 19.89 billion dollars and a net income of 2.65 billion dollars in 2018. Compared to the total revenue in 2017, which is 18.33 billion dollars and net income in 2017, which is 2.47 billion dollars., there is an increase in profits.

Additionally, until May 28, 2019, the current stock price is $129.43. There is a slight decrease in the recent month. However, from the last three months of historical data, there is still
a trend of increasing, and the moving average is generally higher than the history. The MACD chart of this stock in 3 months is shown in Figure 3.1.8. Since the moving average is below the signal moving average, there is a potential of reversal.

![MACD and SMA Chart of DHR from MarketWatch](image)

**Figure 3.1.8 MACD and SMA Chart of DHR from MarketWatch**

### 3.1.9 CHD (Dior)

Christian Dior SE was formed by a French fashion designer, Christian Dior, on December 16, 1946. It is headquartered in Paris and mainly engaged in fashion, jewelry, perfume, cosmetics, and other consumer goods. Christian Dior is also the largest shareholder of LVMH, the largest luxury goods company in the world. It is one of the most famous luxury brands.

According to the financial data from Market Watch, Christian Dior SE has a total revenue of 46.83 billion dollars and a net income of 2.57 billion dollars in 2018. Compared to the total revenue and net income in 2017, which is 43.67 billion dollars and 2.26 billion dollars, there is a slight increase in profits.
Additionally, the year-to-day of this stock is 26.81%. Until May 28, 2019, the current stock price is $480.61. In the past three months, the performance of the stock also increased by 26.81%. The MACD chart of this stock in 3 months are shown in Figure 3.1.9. The general figure is a straight line of rising.

![Figure 3.1.9 MACD and SMA Chart of CHDRY from MarketWatch](image)

3.1.10 ULTA (Ulta Beauty Inc)

Ulta Beauty Inc is one of the chains of beauty store in the United States. The company was established in 1990 and headquartered in Bolingbrook and had over 1000 stores. ULTA mainly engaged in cosmetics and skincare brands, fragrances, nail and hair products, bath and body products, and makeup tools. It also provides specialized services, such as salon in their stores.

According to the financial data from Market Watch, Ulta Beauty Inc has a total revenue of 4.85 billion dollars in 2017, 5.88 billion dollars in 2018, and 6.72 billion dollars in 2019. The net
income of the recent three years is 409.76 million dollars, 555.23 million dollars, and 658.56 million dollars. The general trend of the stock is increasing.

Until May 28, 2019, the current stock price of ULTA is $335.27. Even though there is a slightly decreasing of 4.45% this month, the total trend is still increasing. Also, the moving average is below the signal moving average in the recent month, which means there may exist a potential reversal. The stock has a chance to go back to the right trend. As a result, Ulta Beauty Inc is chosen as one of the companies. The MACD chart of this stock in 3 months are shown in Figure 3.1.10.

![Figure 3.1.10 MACD and SMA Chart of ULTA from MarketWatch](image)

### 3.2 Simulation 1 - Traditional Technical and Swing Trading

This section uses the traditional trading analysis such as swing trading and technical trading to investment for the stock market simulation. We decided to use eight weeks to trade the ten stock we chose in section 3.1 to do the simulation.
3.2.1 Week 1

For the first week of stock market simulation, ULTA, UBER, TVIX, and SPXS were chosen for this week. Since the overall profit was positive at the end of June 3, 2019, we decided to hold the shares we already and added 96 shares of SQQQ on June 4, 2019. We sold ULTA on June 5, 2019, due to the lower profitable. Although TVIX, SPXS, AND SQQQ started to decrease on June 4, 2019, we were waiting for the recovery to prevent losing too much. Since ETFs are influenced seriously by the trade war, we need more information to make the decision. Since Uber has the trend of decreasing on June 6, we decided to sell 100 shares at the beginning of June 7 to keep the profits we already have and lower the risk. Table 3.2.1 below shows the transactions of our stocks in Week One.

Table 3.2.1 Week one report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/3/19</td>
<td>UBER</td>
<td>Buy</td>
<td>40.75</td>
<td>305</td>
<td>12,438.75</td>
<td>---</td>
<td>87,561.25</td>
<td>---</td>
</tr>
<tr>
<td>6/3/19</td>
<td>ULTA</td>
<td>Buy</td>
<td>334.76</td>
<td>35</td>
<td>11,726.60</td>
<td>---</td>
<td>75,834.65</td>
<td>---</td>
</tr>
<tr>
<td>6/3/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>25.55</td>
<td>100</td>
<td>2,565.00</td>
<td>---</td>
<td>73,269.65</td>
<td>---</td>
</tr>
<tr>
<td>6/3/19</td>
<td>SPXS</td>
<td>Buy</td>
<td>22.61</td>
<td>140</td>
<td>3,175.40</td>
<td>---</td>
<td>70,094.25</td>
<td>---</td>
</tr>
<tr>
<td>6/4/19</td>
<td>SQQQ</td>
<td>Buy</td>
<td>45.29</td>
<td>96</td>
<td>4,357.84</td>
<td>---</td>
<td>65,736.41</td>
<td>---</td>
</tr>
<tr>
<td>6/5/19</td>
<td>ULTA</td>
<td>Sell</td>
<td>335.40</td>
<td>35</td>
<td>11,721.18</td>
<td>(5.42)</td>
<td>77,457.59</td>
<td>(5.42)</td>
</tr>
<tr>
<td>6/7/19</td>
<td>UBER</td>
<td>Sell</td>
<td>45.04</td>
<td>100</td>
<td>4494</td>
<td>415.72</td>
<td>81,951.59</td>
<td>410.30</td>
</tr>
</tbody>
</table>

MACD of UBER has already reached the second-lowest point on May 31, 2019, since it first offered and there exist a slightly increasing on the open of June 3, 2019. There is a possibility to gain profits, so we buy 305 shares at $40.41. According to Figure 3.2.1 below, the whole stock
price increased since we traded. However, the SMA became lower than the stock price, and the whole stock has a slight decrease on June 6. At the end of this week, the MACD is lower than the signal-MACD, a potential reversal may appear in week 2.

Figure 3.2.1 UBER’s MACD Chart from 3rd to June 7, 2019

Since ULTA’s MACD has a slight increase since May 31, 2019, we purchase 35 shares at $333.38. However, according to Figure 3.2.2, the moving average became much lower than the stock price on June 5, 2019. This means there is less profitable. Combined with the fact that the price is stable fluctuating from June 3 to June 5, ULTA is not the right choice for us to wait for its profit. We sold the 35 shares we have to prevent more loss on June 5, 2019. However, the price increased after we sold our shares, we seem to make a wrong decision in investment.
TVIX and SPXS have the general trend of increasing in this month, but they started decreasing after we traded the stocks on June 3 and continued to decline in the following days.

According to Figure 3.2.3 and Figure 3.2.4, these two stocks had similar patterns, which had decreased for the whole week.
The stock price of SQQQ has a strange increasing on May 24, 2019. This increased price has last for several days. It decreased on the first day we trade it, but the moving average is higher.
than the stock price at the end of June 4, 2019. According to Figure 3.2.5, the stock price decreased rapidly and resulted in most of the losses in our portfolio.

Compared the figures of these three stocks, the distance of MACD and signal-MACD was small. As a result, we are waiting for a recovery in the future to reduce our loss.

![Figure 3.2.5 SQQQ’s MACD Chart from 3rd to June 7, 2019](image)

At the end of week one, 51% portfolio is for UBER, 21% portfolio is for SQQQ, 16% portfolio is for SPXS, and 12% portfolio is for TVIX. The daily net worth of week one is shown in Table 3.2.2 below. According to this table, the general portfolio is less than $100,000.00. We need to wait for more information to decide on our investment. Since SPXS is an index from S&P500, the stock market did not perform well in week one.
Table 3.2.2 Daily profile performance for week one

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/4/2019</td>
<td>$100,262.45</td>
<td>0.26%</td>
</tr>
<tr>
<td>6/5/2019</td>
<td>$100,417.73</td>
<td>0.42%</td>
</tr>
<tr>
<td>6/6/2019</td>
<td>$100,165.59</td>
<td>0.17%</td>
</tr>
<tr>
<td>6/7/2019</td>
<td>$99,735.48</td>
<td>(0.26%)</td>
</tr>
</tbody>
</table>

3.2.2 Week 2

The second week of the stock market simulation started on June 10, 2019. Based on the data from week one and the stock price of Uber on June 10, 2019, we decided to sell the shares of Uber, we have to keep the largest profits. Since most of our portfolios are for Uber, we gain $1083.20. However, this profit cannot remove the loss of another three stocks. So, we decided to purchase 60 shares of NFLX, because it continues to increase after the depression on June 3, 2019. We seem to make a wrong decision in our investment; all of the four stocks we have were decreasing on June 11, 2019. However, we need to wait for more information for further decisions. On June 12, we decided to maintain the shares we have, because SQQQ, TVIX, and SPXS all have the trend to recovery. There are no other transactions this week. Table 3.2.3 below shows the transactions of stocks in Week Two.

Table 3.2.3 Week two report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy / Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/10/19</td>
<td>UBER</td>
<td>Sell</td>
<td>44.13</td>
<td>205</td>
<td>9,036.65</td>
<td>672.90</td>
<td>90,988.36</td>
<td>1,083.20</td>
</tr>
<tr>
<td>6/10/19</td>
<td>NFLX</td>
<td>Buy</td>
<td>364.78</td>
<td>60</td>
<td>21,896.92</td>
<td>---</td>
<td>69,091.44</td>
<td>1,083.20</td>
</tr>
</tbody>
</table>
Although the general price of SQQQ is not as high as when we are purchasing, it had a slight recovery since June 10. At the end of June 14, the stock price is lower than the SMA (50). There may have a possibility to increase more in the future. We decided to wait for the next-week information before we sell those shares, we have to reduce our losses. Advanced charts of SQQQ is shown in Figure 3.2.6.

However, according to Figure 3.2.7, SPXS have slightly increased on June 10 and June 11, the stock price restored to before. Like SQQQ, SPXS also have a price lower than SMA (50) at the end of June 14. Both have a small float in week 2.

Figure 3.2.6 SQQQ’s MACD Chart from 10td to June 14, 2019
According to Figure 3.2.8, TVIX increased in the first half of the week and then continue to decrease. It reached the lowest stock price this week at the end of June 14. The charts of TVIX and SPXS are similar.
According to Figure 3.2.9, NFLX decreased rapidly after we purchased it on June 10, 2019. The loss of our shares has over $25 per share, and the price has almost reached the lowest price this month. We decided to keep the stocks we already have to wait for a recovery in the future; otherwise, the loss is enormous.

![NFLX's MACD Chart from 10td to June 14, 2019](image)

*Figure 3.2.9 NFLX’s MACD Chart from 10td to June 14, 2019*

At the end of week one, 71% portfolio is for NFLX, 13% portfolio is for SQQQ, 9% portfolio is for SPXS, and 7% portfolio is for TVIX. The daily net worth of week two is shown in Table 3.2.4 below. According to this table, the general portfolio is less than $100,000.00, and we need to wait for more information to decide for our investment. The general stock market did not perform well in this week, because the stock such as SPXS belongs to the S&P 500 did not perform well. Therefore, our ETF did not gain profit.
Table 3.2.4 Daily profile performance for week two

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/10/2019</td>
<td>$98,730.96</td>
<td>(1.27%)</td>
</tr>
<tr>
<td>6/11/2019</td>
<td>$98,685.52</td>
<td>(1.31%)</td>
</tr>
<tr>
<td>6/12/2019</td>
<td>$98,403.08</td>
<td>(1.60%)</td>
</tr>
<tr>
<td>6/13/2019</td>
<td>$98,153.88</td>
<td>(1.85%)</td>
</tr>
<tr>
<td>6/14/2019</td>
<td>$97,956.96</td>
<td>(2.04%)</td>
</tr>
</tbody>
</table>

3.2.3 Week 3

The third week of the stock market simulation started on June 17, 2019. The net worth on June 17, 2019, became higher than June 14. Since they have the trend of recovery, especially for NFLX, we decided to continue to wait for less loss. On June 18, they all have rapidly increased. It seems not a good time to invest, so we decided to wait for the depression and then make the investment. Since SQQQ had the trend towards increasing on June 18, we decided to trade more to remove the loss caused by the previous trade. On the same day, we decided to sell the shares we have of NFLX at the highest we have encountered these days, $361.13. Although the price is lower than the first trade we have, it has reduced the loss. Table 3.2.5 below shows the transactions of chosen stocks in Week Three.

Table 3.2.5 Week three report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/19/19</td>
<td>SQQQ</td>
<td>Buy</td>
<td>36.01</td>
<td>145</td>
<td>5,231.45</td>
<td>---</td>
<td>69,091.44</td>
<td>1,083.20</td>
</tr>
<tr>
<td>6/19/19</td>
<td>NFLX</td>
<td>Sell</td>
<td>361.13</td>
<td>60</td>
<td>21,657.8</td>
<td>(239.12)</td>
<td>85,517.79</td>
<td>844.08</td>
</tr>
</tbody>
</table>
After a long time of decreasing, NFLX increased since June 17. We cannot wait to sell the shares to reduce losses on June 19, after it reached $361.13. However, according to Figure 3.2.10, we seem to make the wrong decision. The stock continues to increase in the following days.

![NFLX's MACD Chart from June 17, 2019, to June 21, 2019](image)

**Figure 3.2.10 NFLX’s MACD Chart from June 17, 2019, to June 21, 2019**

According to Figure 3.2.11, SQQQ continues to decrease. We decided to purchase at a lower price to lower the initial price of our stocks. The general stock price decreased rapidly and have two straights decreased. However, it seems already reach the lowest point of the stock; we are waiting for the recovery in the future.
Figure 3.2.11 SQQQ’s MACD Chart from June 17, 2019, to June 21, 2019

According to Figure 3.2.12, MACD chart of SPXS is very similar to SQQQ. It also had two significant decreases. Like SQQQ, we will not sell the shares now. However, at the end of June 21, there exist a slight increase in the stock price. It may recovery in the next week.

Figure 3.2.12 SPXS’s MACD Chart from 17td to June 21 21 2019
According to Figure 3.2.13, TVIX reached the lowest point on June 19, and then there exists a rapid increase on the same day. However, the growth did not remain for a long time. We are waiting for the recovery in the next week, because there is a slight increase at the end of June 21.

*Figure 3.2.13 TVIX’s MACD Chart from 17th to June 21, 2019*

At the end of week one, 65% portfolio is for SQQQ, 20% portfolio is for SPXS, and 15% portfolio is for TVIX. The daily net worth of week three is shown in Table 3.2.6 below. According to this table, the general portfolio is less than $100,000.00. We need to wait for more information to decide on our investment. Since the shares, we have at the end of this week all belongs to ETF and they all decreased severely, the general stock market did not perform well.
Table 3.2.6 Daily profile performance for week three

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/17/2019</td>
<td>$98,487.04</td>
<td>(1.51%)</td>
</tr>
<tr>
<td>6/18/2019</td>
<td>$98,613.16</td>
<td>(1.39%)</td>
</tr>
<tr>
<td>6/19/2019</td>
<td>$98,553.18</td>
<td>(1.45%)</td>
</tr>
<tr>
<td>6/20/2019</td>
<td>$98,266.24</td>
<td>(1.73%)</td>
</tr>
<tr>
<td>6/21/2019</td>
<td>$98,385.76</td>
<td>(1.61%)</td>
</tr>
</tbody>
</table>

3.2.4 Week 4

The fourth week of the stock market simulation started on June 24, 2019. The shares we hold now are decreasing. However, we are now paying attention to UBER on June 24, because it has a trend of decreasing to the lowest point of this period. Since the increasing trend of UBER is unstable, we decided to invest our money in TQQQ on June 25. At the beginning of June 26, we decided to sell the shares of TQQQ. However, our action is a little bit late. The stock began to decrease and lower than our trading price again. So, we decided to keep it to wait for another chance. On June 27, we sell the shares of TQQQ at the beginning of the day. Table 3.2.7 below shows the transactions of chosen stocks in week four.

Table 3.2.7 Week four report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/25/19</td>
<td>TQQQ</td>
<td>Buy</td>
<td>61.67</td>
<td>300</td>
<td>18,511.00</td>
<td>---</td>
<td>85,517.79</td>
<td>844.08</td>
</tr>
<tr>
<td>6/27/19</td>
<td>TQQQ</td>
<td>Sell</td>
<td>61.85</td>
<td>300</td>
<td>18,545.00</td>
<td>34.00</td>
<td>85,553.29</td>
<td>878.08</td>
</tr>
</tbody>
</table>
According to Figure 3.2.14, the general graph of SQQQ is flat on June 24, and then it encountered an apparent increasing on June 25. However, it decreased rapidly at the beginning of June 25 and then increased again. In the following days, the price has high volatility, but the general price is stable to some degree.

![SQQQ’s MACD Chart from 24th to June 28, 2019](image)

According to Figure 3.2.15, the general trend of SPXS is increasing. Although the graph had high volatility, SPXS has the chance to continue to grow. However, the price stared to decreased since June 26. The only appreciate point is that the price at the end of the day is not as low as the lowest price this week.
According to Figure 3.2.16, the general trend of TVIX is increasing from June 24 to June 25, and it turned to decrease dramatically. The stock reached the lowest stock price at the end of June 28.
According to Figure 3.2.17, the general trend of TQQQ is float on June 24. However, there is a significant decreasing from June 24 to June 25. Then, it straightly increased at the beginning of June 25. However, in the following days, the general stock price is decreasing.

![MACD Chart](image.png)

*Figure 3.2.17 TQQQ’s MACD Chart from 24th to June 28, 2019*

At the end of week one, 65% portfolio is for SQQQ, 20% portfolio is for SPXS, and 15% portfolio is for TVIX. Its percentage of shares is the same as last week. The daily net worth of week three is shown in Table 3.2.8 below. According to this table, the general portfolio is less than $100,000.00. We need to wait for more information to decide on our investment. The three stocks left at the end of this week belongs to ETF. Since they all did not perform well, we can conclude that the general stock market does not have a good performance.
Table 3.2.8 Daily profile performance for week four

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/24/2019</td>
<td>$98,360.68</td>
<td>(1.64%)</td>
</tr>
<tr>
<td>6/25/2019</td>
<td>$98,401.20</td>
<td>(1.60%)</td>
</tr>
<tr>
<td>6/26/2019</td>
<td>$98,492.44</td>
<td>(1.51%)</td>
</tr>
<tr>
<td>6/27/2019</td>
<td>$98,607.56</td>
<td>(1.39%)</td>
</tr>
<tr>
<td>6/28/2019</td>
<td>$98,487.84</td>
<td>(1.51%)</td>
</tr>
</tbody>
</table>

3.2.5 Week 5

The stock market did not perform well on July 1. According to the performance of the S&P 500 and other ETFs, they encounter a serious decreasing at the beginning of this week. Since TVIX dramatically reduced at the beginning of Week Five, we decided to buy more shares at a low price to minimize the loss of our previous shares. However, it is unpredictable that TVIX continuous to decrease after the slight recovery. So, we decided to keep it to wait for another chance. On July 4, there is a short period of empty. Table 3.2.9 below shows the transactions of chosen stocks in Week Five.

Table 3.2.9 Week five report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85,553.29</td>
<td>878.08</td>
</tr>
<tr>
<td>7/1/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>16.89</td>
<td>600</td>
<td>10,144.00</td>
<td>---</td>
<td>75,409.29</td>
<td>878.08</td>
</tr>
</tbody>
</table>

On Monday, TVIX decreased severely, and there is a slight recovery after the straight decreasing. However, it continued to decline in the following days. We seem to make the wrong decision to trade more shares. According to Figure 3.2.18, TVIX has already reached the lowest stock price in three years.
According to Figure 3.2.19, SPXS has the same pattern of TVIX. SPXS also encountered a straight decreasing at the beginning of this week and faced a slight recovery. Although there is another recovery after the short empty period, it does not have the trend to increase.

According to Figure 3.2.20, the graph of SQQQ is also similar to the previous two stock. However, we can find that TVIX decreases the most seriously.

*Figure 3.2.18 TVIX’s MACD Chart from 1st to July 5, 2019*
At the end of week one, 37% portfolio is for SQQQ, 12% portfolio is for SPXS, and 51% portfolio is for TVIX. The daily net worth of week three is shown in Table 3.2.10 below. According to this table, the general portfolio is less than $100,000.00. We need to wait for more information to decide on our investment. The three stocks left at the end of this week belongs to ETF. Since
they all did not perform well, we can conclude that the general stock market does not have a good performance this week.

Table 3.2.10 Daily profile performance for week five

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/1/2019</td>
<td>$97,940.36</td>
<td>(2.06%)</td>
</tr>
<tr>
<td>7/2/2019</td>
<td>$97,705.03</td>
<td>(2.29%)</td>
</tr>
<tr>
<td>7/3/2019</td>
<td>$96,54310</td>
<td>(3.46%)</td>
</tr>
<tr>
<td>7/4/2019</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7/5/2019</td>
<td>$96,892.20</td>
<td>(3.11%)</td>
</tr>
</tbody>
</table>

3.2.6 Week 6

On July 7, all of the three stocks we hold started to increase at the beginning of the day. Since UBER continuous to decrease, we seem to have a chance to invest this stock in this week when it started to recovery. We traded 350 shares of UBER when it began to increase at the beginning of July 9 and quickly sold it when it reached the highest point and started to decrease. Since there is a late update of stock market simulation, we did not successfully sell the shares at the highest pint and get the most profits. However, there is still a slight income. On July 9, we also buy 60 shares of ULTA. Unfortunately, it did not increase as we assumed. Since ULTA decreases after we purchases, we decided to sell it when it first increased to control our loss. Table 3.2.11 below shows the transactions of chosen stocks in Week Six.
Table 3.2.11 Week six report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/9/19</td>
<td>UBER</td>
<td>Buy</td>
<td>43.49</td>
<td>350</td>
<td>15,232.38</td>
<td>---</td>
<td>60,176.91</td>
<td>878.08</td>
</tr>
<tr>
<td>7/9/19</td>
<td>UBER</td>
<td>Sell</td>
<td>43.68</td>
<td>350</td>
<td>15,278.00</td>
<td>45.62</td>
<td>75,454.91</td>
<td>923.70</td>
</tr>
<tr>
<td>7/9/19</td>
<td>ULTA</td>
<td>Buy</td>
<td>351.10</td>
<td>60</td>
<td>21,076.00</td>
<td>---</td>
<td>54,378.91</td>
<td>923.70</td>
</tr>
<tr>
<td>7/12/19</td>
<td>ULTA</td>
<td>Sell</td>
<td>351.75</td>
<td>60</td>
<td>21,094.70</td>
<td>18.70</td>
<td>75,473.61</td>
<td>942.40</td>
</tr>
</tbody>
</table>

On Monday, TVIX encountered a recovery which is higher than last week. According to Figure 3.2.21, the recovery did not last very long, and it started to straight decrease in the following days. The price at the end of the week reaches the lowest stock price this year.

According to Figure 3.2.22 and Figure 3.2.23, they have the same pattern as the chart of TVIX. However, the situations of SQQQ and SPXS are not as difficult as TVIX.
After a period of decrease in last week, UBER has a slight recovery on July 9. We choose the lowest point as a chance to purchase, and quickly sold it when it does not have the trend to increase on the same day. Although there is an increasing at the end of July 9, we already had small profits.
According to Figure 3.2.25, ULTA increased slightly at the beginning of this week and then started to decrease on July 9. However, the decrease does not last for a long time. The stock increased again.

At the end of week one, 50% portfolio is for TVIX, and 38% portfolio is for SQQQ, and 12% portfolio is for SPXS. The daily net worth of week three is shown in Table 3.2.12 below. According to this table, the general portfolio is less than $100,000.00 and even more severe than before. We need to wait for more information to decide on our investment. The three stocks left at
the end of this week belongs to ETF. Since they all did not perform well, we can conclude that the general stock market does not have a good performance this week.

*Table 3.2.12 Daily profile performance for week six*

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/8/2019</td>
<td>$97,138.61</td>
<td>(2.86%)</td>
</tr>
<tr>
<td>7/9/2019</td>
<td>$97,433.34</td>
<td>(2.57%)</td>
</tr>
<tr>
<td>7/10/2019</td>
<td>$96,286.93</td>
<td>(3.71%)</td>
</tr>
<tr>
<td>7/11/2019</td>
<td>$95,880.76</td>
<td>(4.12%)</td>
</tr>
<tr>
<td>7/12/2019</td>
<td>$95,877.58</td>
<td>(4.12%)</td>
</tr>
</tbody>
</table>

### 3.2.7 Week 7

At the beginning of week seven, it is surprising that all the shares we hold have a slight increase and then decreased severely. The condition does not change until Wednesday. Since UBER and NFLX encountered straight decreases at the beginning of July 18, we decided to buy some shares. However, UBER did not increase as we expected, and we only got a few profits from these shares. Since the general stock market is not as optimistic as we expected, we did not do too much trades. Table 3.2.13 below shows the transactions of chosen stocks in Week Seven.

*Table 3.2.13 Week seven report of transactions*

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75,473.61</td>
<td>942.40</td>
</tr>
<tr>
<td>7/18/19</td>
<td>UBER</td>
<td>Buy</td>
<td>43.32</td>
<td>100</td>
<td>4,342.00</td>
<td>---</td>
<td>71,131.61</td>
<td>942.40</td>
</tr>
<tr>
<td>7/18/19</td>
<td>NFLX</td>
<td>Buy</td>
<td>329.62</td>
<td>60</td>
<td>19,787.20</td>
<td>---</td>
<td>51,344.45</td>
<td>942.40</td>
</tr>
<tr>
<td>7/19/19</td>
<td>UBER</td>
<td>Sell</td>
<td>43.68</td>
<td>100</td>
<td>4,358.00</td>
<td>16.00</td>
<td>55,702.45</td>
<td>958.40</td>
</tr>
</tbody>
</table>
According to Figure 3.2.26, TVIX like a black hole, it continues to decreased until the noon of July 16. However, the recovery did not last for an extended period. On the last day, July 18, another recovery appeared. We seem made a wrong decision on July 17. If we sell the shares we have at the highest price in this week, we can control the loss.

According to Figure 3.2.27, the chart of SPXS was similar to the chart of TVIX. The only different point is that SPXS did not have a significant trend of decreasing at the beginning of week seven.

*Figure 3.2.26 TVIX’s MACD Chart from 15th to July 19, 2019*
According to Figure 3.2.28, SQQQ also had a similar pattern of TVIX and SPXS. Thursday seems to be a good chance to prevent more loss for all of the three stocks we hold. However, it is a pity that we lost this chance.
According to Figure 3.2.29, the general chart of UBER had a trend of decreasing. At the beginning of July 17, there was a significant decrease followed with a slight recovery. However, the recovery did not last for a long time. In the following days, the general chart was almost flat. According to Figure 3.2.30, there also exists a significant decrease in more severe than UBER. The general stock price was smooth but separate in two different degrees. The differences between prices in week seven are huge.

Figure 3.2.29 UBER’s MACD Chart from 15th to 19th July 2019
At the end of week one, 47% portfolio is for NFLX, 26% portfolio is for TVIX, and 20% portfolio is for SQQQ, and 6% portfolio is for SPXS. The daily net worth of week three is shown in Table 3.2.14 below. According to this table, the general portfolio is less than $100,000.00 and even more severe than before. We need to wait for more information to decide on our investment.

It was evident that Wednesday lossless, but we lose the chance to control the loss. As a result, we can find in the table that it existed a severe loss on Thursday and Friday. Some of the stocks left at the end of this week belong to ETF. Since they all did not perform well, we can conclude that the general stock market does not have a good performance this week.
### Table 3.2.14 Daily profile performance for week seven

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/15/2019</td>
<td>$95,472.09</td>
<td>(4.53%)</td>
</tr>
<tr>
<td>7/16/2019</td>
<td>$95,657.77</td>
<td>(4.34%)</td>
</tr>
<tr>
<td>7/17/2019</td>
<td>$96,216.63</td>
<td>(3.78%)</td>
</tr>
<tr>
<td>7/18/2019</td>
<td>$95,723.15</td>
<td>(4.28%)</td>
</tr>
<tr>
<td>7/19/2019</td>
<td>$95,505.71</td>
<td>(4.49%)</td>
</tr>
</tbody>
</table>

#### 3.2.8 Week 8

At the beginning of week eight, the shares we hold did not have a good performance. Although there is a slightly increased at the beginning of July 23, the stocks decreased like a black hole. The general trend of the stock market is falling based on the performances of ETFs we hold. On July 25, there existed a recovery on NFLX. It seems to be a good chance for us to control our loss. However, we still did not find the opportunity to stop the loss of our ETFs. Table 3.2.15 below shows the transactions of chosen stocks in Week Eight.

### Table 3.2.15 Week eight report of transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost/Proceeds</th>
<th>Profit</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/25/19</td>
<td>NFLX</td>
<td>Sell</td>
<td>331.42</td>
<td>60</td>
<td>19,875.45</td>
<td>88.25</td>
<td>75,577.90</td>
<td>1046.65</td>
</tr>
</tbody>
</table>

According to Figure 3.2.31, the general trend of TVIX is still decreasing in this week. There existed a recovery on July 24; however, it does not last for a long time. The unstable situation only remained for one day and continued to decrease again.
Figure 3.2.31 TVIX's MACD Chart from 22nd to July 26, 2019

According to Figure 3.2.32, the chart of SPXS was similar to the chart of TVIX. There is also a possible increase on July 24; however, the recovery failed.

Figure 3.2.32 SPXS's MACD Chart from 22nd to July 26, 2019
According to Figure 3.2.33, SQQQ also had a similar pattern of TVIX and SPXS. The decreasing trend seems to be straighter than the previous two. We seem lost the good chance to control the loss in this week again.

![Figure 3.2.33 SQQQ’s MACD Chart from 22nd to July 26, 2019](image)

After a period of decreasing after trading, NFLX encountered an optimistic increasing since July 23. According to Figure 3.2.34, the increase is smooth, without too much inflation. It provides us a good chance to gain a small profit on Friday, July 26.
At the end of week one, 48% portfolio is for TVIX, 39% portfolio is for SQQQ, and 13% portfolio is for SPXS. The daily net worth of week three is shown in Table 3.2.16 below. Since this is the last week of trading of our stock market simulation, we did not get a positive experience for our future investment. Although the general stock market increased, the previous stocks we build a block for us.

Table 3.2.16 Daily profile performance for week seven

<table>
<thead>
<tr>
<th>Date</th>
<th>Net Worth</th>
<th>% Return (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/22/2019</td>
<td>$94,686.72</td>
<td>(5.31%)</td>
</tr>
<tr>
<td>7/23/2019</td>
<td>$93,535.12</td>
<td>(6.46%)</td>
</tr>
<tr>
<td>7/24/2019</td>
<td>$93,551.45</td>
<td>(6.45%)</td>
</tr>
<tr>
<td>7/25/2019</td>
<td>$94,805.33</td>
<td>(5.19%)</td>
</tr>
<tr>
<td>7/26/2019</td>
<td>$94,396.63</td>
<td>(5.60%)</td>
</tr>
</tbody>
</table>
3.2.9 Simulation 1 Result

After a period of eight-week stock simulation through traditional technical trading method and swing trading method, we lost $5,603.37 on our $100,000.00 investment. Table 3.2.17 and Figure 3.2.35 show the total value at the end of each week on my profile for the eight-week simulation. The total value was lower than $100,000.00 after the first week, and then the total value decreased again in Week Two, followed with an increase in the following weeks. Until Week Four, the total value per week encounters another decreasing.

Table 3.2.17 Total Value Per Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 0</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Week 1</td>
<td>$99,735.48</td>
</tr>
<tr>
<td>Week 2</td>
<td>$97,956.96</td>
</tr>
<tr>
<td>Week 3</td>
<td>$98,385.76</td>
</tr>
<tr>
<td>Week 4</td>
<td>$98,487.84</td>
</tr>
<tr>
<td>Week 5</td>
<td>$96,892.20</td>
</tr>
<tr>
<td>Week 6</td>
<td>$95,877.58</td>
</tr>
<tr>
<td>Week 7</td>
<td>$95,505.71</td>
</tr>
<tr>
<td>Week 8</td>
<td>$94,396.63</td>
</tr>
</tbody>
</table>

Figure 3.2.35 Total Value Per Week
The total cash on our account was low in the stock market simulation is because we lost several times to control our losses. The shares we trade in the first week decreased severely, and there were several slightly recoveries in the following weeks. However, we did not pay much attention to the slight recovery and waiting for a greater profit. As a result, the stock prices became lower and lower. According to Figure 3.2.35, since the total value per week was always less than $100,000.00, we did not get the profits from the stock market simulation. The loss of our simulation can generate a linear distribution of increasing. SQQQ, SPXS, and TVIX caused the general loss. Since we wanted the recovery of these stocks, the total profits lost more rather than increased.

3.3 Simulation 2 - Technical analysis combined with Fundamental Analysis

This simulation is designed as a comparison with a fundamental track. We are trying to explore the effectiveness of fundamental analysis and technical analysis for stock trading. For the most of this section, we use the simple moving average to find Crossovers and use Fast Fourier method and LSTM model to determinate the price range.

3.3.0 Preparation: Developing Moving Average and LSTM model for technical training

Last week, we noticed that the data set for UBER and CHDRF is extremely small, we decided not to wait for another week, so that we can collect more data to see the pattern. This week, the technical analysis track is improving the moving average and LSTM model. The detail code is attached in Appendix A&B.

LSTM model

As we noticed, the moving average is not applicable to all the stocks that we are watching. Thus, we made the LSTM model to predict stock price. We use the dataset of UPRO while
developing, and it gives a highly correlated relationship between our prediction and the real price.

The detail code of LSTM model is attached in Appendix B.

![Prediction vs Real Stock Price of UPRO](image)

**Figure 3.3.1. Prediction vs. Real Stock Price of UPRO**

### 3.3.1 Week 1

In this week, we did eight transactions with two stocks and 3 ETFs as summarized by Table 3.3.1. On Monday, and the stock market advances nicely in the morning. We use the 10-day moving average line, 20-day moving average line, and the 50-day average line to help analyze the ETF ‘TQQQ.’ The 10-day moving average line and the 20-day moving average line are both under the price on June 9th, 2019. Though we are not entirely sure when its price will go down again, considering the upcoming G20 event and potential expectation of volatility, we can predict a downward trend of ‘TQQQ’ in the following days confidently. Since the price is still going upward on June 10th without specific news as a support, we decided to sell short ‘TQQQ.’ We sell short 500 shares at a market price of $59.38 at noon and then set up a warning when its price declines to $58. We cover the entire 500 shares at $57.97 on June 12th, 2019.
We also brought in 1000 shares of TVIX and 500 shares of UPRO on Monday morning. We decided to hold these two ETFs for a longer period. We brought TVIX at $21.00 on Monday as well for two reasons:

1. TVIX is at its lowest price level in this period
2. The strained relationship between the US and China is likely to extend to the G20 summit and affect the expectation of volatility, causing the price of “TVIX” raise.

So, we decided to place a limit order of “TVIX” late next week. The precise price needs to be calculated by then.

We brought UPRO twice last week. Unlike “TVIX”, “UPRO” is already reach a high position. According to the Elliott Wave theory, “UPRO” is likely at the third wave. An indicator is the slope of the previous upward trend is approximately 0.618 of the ongoing one. In fact, we were buying in more for an experimental reason, so we will keep watching it closely next week.
On Wednesday (June 12th), we sell short “DHR” (Danaher), simply because of the price of DHR exceed all its moving average lines. Later, the losses prove that we are wrong. Though we insist that the price level of Danaher will eventually come back to the expectation, it’s not a good decision to sell short Danaher right now. In fact, we noticed later that the biology industry is one place money managers like to invest in when the economy is slowing down because it gives good gain even in the recession. We decided to cover the entire 400 shares on next Monday or Tuesday with a fair price and start to buy Danaher and make a swing trade. We are still looking for a chance to sell short Danaher in the meantime.

Figure 3.3.3 DHR and its 10-day rolling mean, 20-day rolling mean, 50-day rolling mean on 6/13/2019

We also brought “NFLX” (Netflix) on June 12th. By looking at the 10-day, 20-day, 50-day moving average line, Netflix is showing good potential to reach $350 in the following weeks. For next week, we are going to sell half of the “NFLX” we are holding at $343, and the other half at
$345. The two-price level is given from experience. We will cross-validate the number using the LSTM model.

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/10/19</td>
<td>TQQQ</td>
<td>Short</td>
<td>59.38</td>
<td>500</td>
<td>29,680.00</td>
<td>---</td>
<td>129,680.00</td>
<td>---</td>
</tr>
<tr>
<td>6/10/19</td>
<td>UPRO</td>
<td>Buy</td>
<td>52.21</td>
<td>500</td>
<td>(26,115.00)</td>
<td>---</td>
<td>103,565.00</td>
<td>---</td>
</tr>
<tr>
<td>6/11/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>21.00</td>
<td>1,000</td>
<td>(21,010.00)</td>
<td>---</td>
<td>82,555.00</td>
<td>---</td>
</tr>
<tr>
<td>6/12/19</td>
<td>TQQQ</td>
<td>Cover</td>
<td>57.97</td>
<td>500</td>
<td>(28,995.00)</td>
<td>685.00</td>
<td>53,560.00</td>
<td>685.00</td>
</tr>
<tr>
<td>6/12/19</td>
<td>UPRO</td>
<td>Buy</td>
<td>51.03</td>
<td>200</td>
<td>(10,216.00)</td>
<td>---</td>
<td>43,344.00</td>
<td>---</td>
</tr>
<tr>
<td>6/13/19</td>
<td>NFLX</td>
<td>Buy</td>
<td>45.29</td>
<td>200</td>
<td>(68,394.00)</td>
<td>(25,050.00)</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6/14/19</td>
<td>DHR</td>
<td>Short</td>
<td>341.92</td>
<td>200</td>
<td>27,990.00</td>
<td>---</td>
<td>2,940.00</td>
<td>---</td>
</tr>
<tr>
<td>6/14/19</td>
<td>DHR</td>
<td>Short</td>
<td>139.68</td>
<td>200</td>
<td>27,926.00</td>
<td>---</td>
<td>30,866.00</td>
<td>---</td>
</tr>
</tbody>
</table>

*Figure 3.3.4 NFLX and its 10-day rolling mean, 20-day rolling mean, 50-day rolling mean on 6/12/2019*
3.3.2 Week 2

Last week, the overall gain reached 0% again on Friday. On June 17th, we covered the 400 shares DHR. Last week, we decided to sell short DHR since its value exceeded all the moving average line. We mistakenly interpreted that as a signal of selling DHR, since we can’t find any support to explain that sudden rise. However, we noticed that investors prefer the Bio-tech industry under an unclear situation, like now, because of its steady growth. So, we cover the DHR and buy 200 shares instead.

On the beginning of June 18th, we were holding three stocks: 200 shares of DHR, 1000 shares of TVIX, 700 shares of UPRO, 200 shares of NFLX. We sold all the TVIX, UPRO and NFLX. Both UPRO and NFLX gives us a good return, and we sold TVIX since it reached the stop-losses position that we set initially. But later, we overturned the judgment we made previously: We buy in 800 shares of TVIX, because it is at its lowest position since January, and the coming G20 is likely to bring up its price. We also buy in 400 shares of UPRO and set up a stop-profit position. The overall percentage return by the end of that day is 3.71%.

On June 19th, the pending order of selling UPRO executed and TVIX kept going down. The overall percentage return by the end of that day went down to 3.14%.

On June 20th, before the market was opened, FOMC maintained the fed rate at its current level, and as a direct result, most of the stocks went up on that day. We abandoned the moving average method for predicting the price. Without technical analysis, the prediction becomes a mess. The overall percentage return went down to 1.6%.

On June 21st, we buy in 300 shares of UBER and 500 shares of TVIX. The overall percentage of return went back to 1.9%.
### Table 3.3.2 Transaction History of Week Two

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/ Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/ Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/17/19</td>
<td>DHR</td>
<td>Buy</td>
<td>139.99</td>
<td>200</td>
<td>(28,008.00)</td>
<td>---</td>
<td>2,858.00</td>
<td>685.00</td>
</tr>
<tr>
<td>6/17/19</td>
<td>DHR</td>
<td>Cover</td>
<td>139.97</td>
<td>400</td>
<td>(55,998.00)</td>
<td>(82.00)</td>
<td>(53,140.00)</td>
<td>603.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>NFLX</td>
<td>Sell</td>
<td>357.59</td>
<td>201</td>
<td>71,865.59</td>
<td>3,104.00</td>
<td>18,725.59</td>
<td>3,707.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>NFLX</td>
<td>Buy</td>
<td>357.59</td>
<td>1</td>
<td>(367.59)</td>
<td>---</td>
<td>18,358.00</td>
<td>3,707.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>19.92</td>
<td>800</td>
<td>(15,946.00)</td>
<td>---</td>
<td>2,412.00</td>
<td>3,707.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>TVIX</td>
<td>Sell</td>
<td>19.71</td>
<td>1,000</td>
<td>19,700.00</td>
<td>(1,310.00)</td>
<td>22,112.00</td>
<td>2,397.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>UPRO</td>
<td>Buy</td>
<td>53.42</td>
<td>400</td>
<td>(21,378.00)</td>
<td>---</td>
<td>734.00</td>
<td>2,397.00</td>
</tr>
<tr>
<td>6/18/19</td>
<td>UPRO</td>
<td>Sell</td>
<td>53.42</td>
<td>700</td>
<td>37,384.00</td>
<td>1,053.00</td>
<td>38,118.00</td>
<td>3,450.00</td>
</tr>
<tr>
<td>6/19/19</td>
<td>UPRO</td>
<td>Sell</td>
<td>53.55</td>
<td>400</td>
<td>21,410.00</td>
<td>$32.00</td>
<td>128,662.00</td>
<td>3,482.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>TQQQ</td>
<td>Sell</td>
<td>63.65</td>
<td>600</td>
<td>38,180.00</td>
<td>(440.00)</td>
<td>97,708.00</td>
<td>3,042.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>TQQQ</td>
<td>Buy</td>
<td>64.35</td>
<td>600</td>
<td>(38,620.00)</td>
<td>---</td>
<td>59,088.00</td>
<td>3,042.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>TVIX</td>
<td>Cover</td>
<td>18.46</td>
<td>500</td>
<td>(9,240.00)</td>
<td>(205.00)</td>
<td>49,848.00</td>
<td>2,837.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>TVIX</td>
<td>Short</td>
<td>18.09</td>
<td>500</td>
<td>9,035.00</td>
<td>---</td>
<td>58,883.00</td>
<td>2,837.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>TVIX</td>
<td>Sell</td>
<td>18.10</td>
<td>800</td>
<td>14,470.00</td>
<td>(1,476.00)</td>
<td>73,353.00</td>
<td>1,361.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>UPRO</td>
<td>Sell</td>
<td>54.91</td>
<td>500</td>
<td>27,445.00</td>
<td>(175.00)</td>
<td>100,798.00</td>
<td>1,186.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>UPRO</td>
<td>Buy</td>
<td>55.22</td>
<td>500</td>
<td>(27,620.00)</td>
<td>---</td>
<td>73,178.00</td>
<td>1,186.00</td>
</tr>
<tr>
<td>6/20/19</td>
<td>UBER</td>
<td>Buy</td>
<td>44.86</td>
<td>300</td>
<td>(13,468.00)</td>
<td>---</td>
<td>59,710.00</td>
<td>1,186.00</td>
</tr>
<tr>
<td>6/21/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>19.20</td>
<td>500</td>
<td>(9,610.00)</td>
<td>---</td>
<td>50,100.00</td>
<td>1,186.00</td>
</tr>
</tbody>
</table>

### 3.3.3 Week 3

In general, the market goes bull for the entire week. We buy in DHR, NFLX, UBER, and TQQQ earlier this week. Unfortunately, we buy in NFLX and UBER at its highest value on Monday. So, we soon sold them within an hour. Then we buy in 350 shares of DHR, short 500 shares of YINN, and buy-in 800 shares of TVIX on Tuesday. On Wednesday morning, The
Washington Post announced that China Bank of Communication, Shanghai Pudong Development Bank, and China Merchants Bank at risk of losing access to US dollars. That risk event brought the price of TVIX by 5%. So, we set a limit pending order, hoping it will increase by 10% just like what happened on May 13th. But that order didn’t execute. The price of DHR and TVIX kept going down until the end of that week.

Table 3.3.3 Transaction History of Week Three

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash/Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/24/19</td>
<td>DHR</td>
<td>Sell</td>
<td>142.92</td>
<td>500</td>
<td>71,450.00</td>
<td>298.00</td>
<td>121,550.00/1,484.00</td>
</tr>
<tr>
<td>6/24/19</td>
<td>DHR</td>
<td>Buy</td>
<td>143.78</td>
<td>300</td>
<td>(43,144.00)</td>
<td>---</td>
<td>78,406.00/1,484.00</td>
</tr>
<tr>
<td>6/24/19</td>
<td>NFLX</td>
<td>Sell</td>
<td>371.86</td>
<td>135</td>
<td>50,191.10</td>
<td>(272.45)</td>
<td>128,597.10/1,211.55</td>
</tr>
<tr>
<td>6/24/19</td>
<td>NFLX</td>
<td>Buy</td>
<td>373.73</td>
<td>135</td>
<td>(50,463.55)</td>
<td>---</td>
<td>78,133.55/1,211.55</td>
</tr>
<tr>
<td>6/24/19</td>
<td>TQQQ</td>
<td>Buy</td>
<td>63.67</td>
<td>300</td>
<td>(19,111.00)</td>
<td>---</td>
<td>59,022.55/1,211.55</td>
</tr>
<tr>
<td>6/24/19</td>
<td>UBER</td>
<td>Sell</td>
<td>43.51</td>
<td>300</td>
<td>13,043.00</td>
<td>(425.00)</td>
<td>72,065.55/786.55</td>
</tr>
<tr>
<td>6/25/19</td>
<td>DHR</td>
<td>Buy</td>
<td>142.84</td>
<td>350</td>
<td>(50,004.00)</td>
<td>---</td>
<td>22,061.55/786.55</td>
</tr>
<tr>
<td>6/25/19</td>
<td>TQQQ</td>
<td>Sell</td>
<td>62.72</td>
<td>300</td>
<td>18,806.00</td>
<td>(305.00)</td>
<td>40,867.55/481.55</td>
</tr>
<tr>
<td>6/25/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>19.58</td>
<td>800</td>
<td>(15,674.00)</td>
<td>---</td>
<td>25,193.55/481.55</td>
</tr>
<tr>
<td>6/25/19</td>
<td>TVIX</td>
<td>Sell</td>
<td>19.72</td>
<td>500</td>
<td>9,850.00</td>
<td>240.00</td>
<td>35,043.55/721.55</td>
</tr>
<tr>
<td>6/25/19</td>
<td>YINN</td>
<td>Short</td>
<td>20.17</td>
<td>500</td>
<td>10,075.00</td>
<td>---</td>
<td>45,118.55/721.55</td>
</tr>
</tbody>
</table>

3.3.4 Week 4

The G20 summit was held during this weekend. The negotiation between the US government and the China government seems to reach a saddle point. Notice that, we are still holding TVIX on that Monday, so we lost about 9% of its value at the very beginning of the day. That gave us an important lesson on risk management.
On Tuesday, we buy in ULTA beauty based on the golden cross of SMA30 and SMA70. We also short the NFLX based on the same reason.

The market was closed on Thursday because of the Independence Day. On the beginning of Friday, the non-farm payrolls data has been released. The NFP was way better than expected, which low down the expectation of rate cut.

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**Figure 3.3.5 ULTA and its 10-day rolling mean, 30-day rolling mean, 70-day rolling mean on 7/2/2019**

**Figure 3.3.6 NFLX and its 10-day rolling mean, 30-day rolling mean, 70-day rolling mean on 7/5/2019**
Table 3.3.4 Transaction History of Week Four

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/1/19</td>
<td>TQQQ</td>
<td>Buy</td>
<td>64.99</td>
<td>200</td>
<td>(13,008.00)</td>
<td>---</td>
<td>32,110.55</td>
<td>721.55</td>
</tr>
<tr>
<td>7/1/19</td>
<td>TVIX</td>
<td>Sell</td>
<td>16.96</td>
<td>800</td>
<td>13,558.00</td>
<td>(2,116.00)</td>
<td>45,668.55</td>
<td>(1,394.45)</td>
</tr>
<tr>
<td>7/1/19</td>
<td>YINN</td>
<td>Buy</td>
<td>22.55</td>
<td>1,000</td>
<td>(22,560.00)</td>
<td>---</td>
<td>19,543.55</td>
<td>(1,394.45)</td>
</tr>
<tr>
<td>7/1/19</td>
<td>YINN</td>
<td>Cover</td>
<td>22.66</td>
<td>500</td>
<td>(11,340.00)</td>
<td>(1,265.00)</td>
<td>11,768.55</td>
<td>(2,659.45)</td>
</tr>
<tr>
<td>7/1/19</td>
<td>SWKS</td>
<td>Buy</td>
<td>82.74</td>
<td>370</td>
<td>(30,623.80)</td>
<td>---</td>
<td>(18,855.25)</td>
<td>(2,659.45)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>DHR</td>
<td>Short</td>
<td>143.53</td>
<td>100</td>
<td>14,343.00</td>
<td>---</td>
<td>(4,512.25)</td>
<td>(2,659.45)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>DHR</td>
<td>Sell</td>
<td>143.43</td>
<td>350</td>
<td>50,190.50</td>
<td>186.50</td>
<td>45,678.25</td>
<td>(2,472.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>TQQQ</td>
<td>Sell</td>
<td>63.98</td>
<td>200</td>
<td>12,786.00</td>
<td>(222.00)</td>
<td>58,464.25</td>
<td>(2,694.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>TVIX</td>
<td>Buy</td>
<td>16.30</td>
<td>300</td>
<td>(4,900.00)</td>
<td>---</td>
<td>53,564.25</td>
<td>(2,694.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>YINN</td>
<td>Sell</td>
<td>22.14</td>
<td>1,000</td>
<td>22,130.00</td>
<td>(430.00)</td>
<td>75,694.25</td>
<td>(3,124.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>ULTA</td>
<td>Sell</td>
<td>342.32</td>
<td>100</td>
<td>34,222.00</td>
<td>---</td>
<td>109,916.25</td>
<td>(3,124.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>ULTA</td>
<td>Buy</td>
<td>341.88</td>
<td>300</td>
<td>(102,574.00)</td>
<td>---</td>
<td>7,342.25</td>
<td>(3,124.95)</td>
</tr>
<tr>
<td>7/2/19</td>
<td>SWKS</td>
<td>Sell</td>
<td>80.64</td>
<td>370</td>
<td>29,826.80</td>
<td>(797.00)</td>
<td>37,169.05</td>
<td>(3,921.95)</td>
</tr>
<tr>
<td>7/3/19</td>
<td>DHR</td>
<td>Cover</td>
<td>144.93</td>
<td>100</td>
<td>(14,503.00)</td>
<td>(160.00)</td>
<td>22,666.05</td>
<td>(4,081.95)</td>
</tr>
<tr>
<td>7/3/19</td>
<td>DHR</td>
<td>Buy</td>
<td>144.83</td>
<td>200</td>
<td>(28,976.00)</td>
<td>---</td>
<td>(6,309.95)</td>
<td>(4,081.95)</td>
</tr>
<tr>
<td>7/3/19</td>
<td>UPRO</td>
<td>Sell</td>
<td>56.38</td>
<td>400</td>
<td>22,542.00</td>
<td>(44.00)</td>
<td>16,232.05</td>
<td>(4,125.95)</td>
</tr>
<tr>
<td>7/3/19</td>
<td>UPRO</td>
<td>Buy</td>
<td>56.44</td>
<td>400</td>
<td>(22,586.00)</td>
<td>---</td>
<td>(6,353.95)</td>
<td>(4,125.95)</td>
</tr>
<tr>
<td>7/3/19</td>
<td>ULTA</td>
<td>Sell</td>
<td>345.36</td>
<td>150</td>
<td>51,794.00</td>
<td>---</td>
<td>45,440.05</td>
<td>(4,125.95)</td>
</tr>
<tr>
<td>7/5/19</td>
<td>NFLX</td>
<td>Short</td>
<td>379.10</td>
<td>150</td>
<td>56,855.00</td>
<td>---</td>
<td>102,295.05</td>
<td>(4,125.95)</td>
</tr>
<tr>
<td>7/5/19</td>
<td>ULTA</td>
<td>Sell</td>
<td>345.31</td>
<td>50</td>
<td>17,255.50</td>
<td>737.50</td>
<td>119,550.55</td>
<td>(3,388.45)</td>
</tr>
</tbody>
</table>

3.3.5 Week 5

On Tuesday, we brought in the SPXS. Based on the graph, it showed a golden cross. So we brought in 1000 shares at the price of $17.88. We decided to keep holding DHR. Even its price
went down a little bit, in the unstable global environment, we insisted that making a long-term investment on a biotech company with a healthy financial background is the right decision. Also, considering multiple risk events like global conflicts between Iran and the US and the expectation of a rate cut, we decided to reduce position and kept seeking stocks with low beta value.

![Figure 3.3.7 SPXS and its 10-day rolling mean, 30-day rolling mean, 70-day rolling mean on 7/8/2019](image)

**Table 3.3.5 Transaction History of Week Five**

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/ Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/8/19</td>
<td>TVIX</td>
<td>Sell</td>
<td>16.43</td>
<td>300</td>
<td>4,919.00</td>
<td>19.00</td>
<td>124,469.55</td>
<td>(3,369.45)</td>
</tr>
<tr>
<td>7/9/19</td>
<td>NFLX</td>
<td>Cover</td>
<td>380.74</td>
<td>150</td>
<td>(57,121.00)</td>
<td>(266.00)</td>
<td>67,348.55</td>
<td>(3,635.45)</td>
</tr>
<tr>
<td>7/9/19</td>
<td>SPXS</td>
<td>Buy</td>
<td>17.88</td>
<td>1,000</td>
<td>(17,890.00)</td>
<td>---</td>
<td>49,458.55</td>
<td>(3,635.45)</td>
</tr>
</tbody>
</table>
3.3.6 Week 6

In week 6, on Monday, China releases its half-year data. The GDP growth rate remains 6.2%. The import and export measured in US dollar decrease as an effect of the trade war. It seems that the trade war is not going to be the major event that affects the market for next week.

We sold short ULTA on Thursday since its price is significantly higher than its SMA10 and SMA30, as shown in the graph below. We covered it on Friday morning.

![ULTA and its 10-day rolling mean, 30-day rolling mean, 70-day rolling mean on 7/18/2019](image)

We sold SPXS at $17.24, and brought in TQQQ, because of the rate-cutting signal given by Powell’s speech. We also brought in BILI, a Chinese video-sharing website, for its outstanding performance among its industry. We thought that performance is undervalued for now.

Noticing that on Friday, four countries release signal of cutting interest, and Powell’s speech is likely to signal monetary easing. Based on that, we will focus on US Q2 GDP growth, the monetary policy of major countries for next week.
### Table 3.3.6 Transaction History of Week Six

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/18/19</td>
<td>ULTA</td>
<td>Short</td>
<td>368.07</td>
<td>200</td>
<td>73,604.00</td>
<td></td>
<td>49,458.55</td>
<td>(3,635.45)</td>
</tr>
<tr>
<td>7/19/19</td>
<td>TQQQ</td>
<td>Buy</td>
<td>68.24</td>
<td>200</td>
<td>(13,658.00)</td>
<td></td>
<td>109,404.55</td>
<td></td>
</tr>
<tr>
<td>7/19/19</td>
<td>BILI</td>
<td>Buy</td>
<td>15.54</td>
<td>1,000</td>
<td>(15,550.00)</td>
<td></td>
<td>93,854.55</td>
<td></td>
</tr>
<tr>
<td>7/19/19</td>
<td>SPXS</td>
<td>Sell</td>
<td>17.24</td>
<td>1,000</td>
<td>17,230.00</td>
<td>(660.00)</td>
<td>111,084.55</td>
<td>(4,295.45)</td>
</tr>
<tr>
<td>7/19/19</td>
<td>ULTA</td>
<td>Cover</td>
<td>365.20</td>
<td>200</td>
<td>(73,050.00)</td>
<td>554.00</td>
<td>38,034.55</td>
<td>(3,741.45)</td>
</tr>
</tbody>
</table>

### 3.3.7 Week 7

On Monday, we decide to keep holding the TQQQ and BILI, and meanwhile seeking a reasonable price to sell DHR. As shown in the figure below, DHR has lost its rising support as the trade talk moves into the new stage. Therefore, we will keep watching for a good chance to sell all the DHR we hold this week.
On the other hand, we decided to hold TQQQ and BILI. Since the US second-quarter economic report would be released in the middle of this week ahead of the Federal Open Market Committee’s monetary policy decision next week, the price of TQQQ and BILI would rise as long as any good signal shows up in these two events.

The US released its Q2 economy data on Wednesday and Thursday. Economic growth was stronger than expected. While the report indicated a slowdown of growth rate, but the magnitude of deceleration was less than economists’ expectation. Strong result of personal consumption leads the bull market. A few companies released its latest financial reports, Alphabet for example, which helped support the upward trend.

On Friday, we sold all the three stocks we held and finished the simulation.
Table 3.3.7 Transaction History of Week Seven

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Buy/Sell</th>
<th>Price (Share)</th>
<th>Shares</th>
<th>Net Cost / Proceeds</th>
<th>Profit/Loss</th>
<th>Total Cash</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/26/19</td>
<td>DHR</td>
<td>Sell</td>
<td>142.28</td>
<td>200</td>
<td>28,446.00</td>
<td>(530.00)</td>
<td>66,480.55</td>
<td>(4,271.45)</td>
</tr>
<tr>
<td>7/26/19</td>
<td>BILI</td>
<td>Sell</td>
<td>15.96</td>
<td>1,000</td>
<td>15,950.00</td>
<td>400.00</td>
<td>82,430.55</td>
<td>(3,871.45)</td>
</tr>
<tr>
<td>7/26/19</td>
<td>TQQQ</td>
<td>Sell</td>
<td>70.07</td>
<td>200</td>
<td>14,004.00</td>
<td>346.00</td>
<td>96,434.55</td>
<td>(3,525.45)</td>
</tr>
</tbody>
</table>

3.3.8 Simulation 2 Result

We finished the seven-week long simulation two using moving average to trade and some fundamental analysis as a substitute. We start with a margin account with $100,000 and $96,457. In the first two weeks of trading, we keep gaining, and the total profit reaches $4000. However, by the end of the third week, we held a bear position given by the passive signal release prior to the G20 Summit. However, China and the US announced they are going to start a new round of negotiations, which provide strong support for the stock market in the first week of July. We lost approximately $4,000 in that wrong decision, and the total profit keeps decreasing in the fifth and sixth week. In the last two weeks, we manage to bring the loss back to $3,500.
### Table 3.3.8 Total Value Per Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>$100,685.00</td>
</tr>
<tr>
<td>Week 2</td>
<td>$101,186.00</td>
</tr>
<tr>
<td>Week 3</td>
<td>$100,721.55</td>
</tr>
<tr>
<td>Week 4</td>
<td>$96,611.55</td>
</tr>
<tr>
<td>Week 5</td>
<td>$96,364.55</td>
</tr>
<tr>
<td>Week 6</td>
<td>$96,258.55</td>
</tr>
<tr>
<td>Week 7</td>
<td>$96,474.55</td>
</tr>
</tbody>
</table>

#### Figure 3.3.10 Total Value per Week
Chapter 4: Analysis and Comparison

We completed the eight-week simulation using traditional technical and swing trading, and the seven-week simulation using Technical analysis combined with fundamental analysis. The final balances are $94,396.63 and $96,474.55, yields a percentage return for -5.6% and -3.6%. Both simulations did not perform well.

Compare our results with the market, the Dow Jones Industrial Average rose about 4.3%, and the NASDAQ rose 6.5%, and the S&P 500 rose 4.8% in the eight weeks.

In our stock simulation, technical trading combined with fundamental analysis performed better. However, the frequently happened risk events in that specific time frame might be the direct cause. Technical analysis cannot interpret the risk events as sensitive as fundamental analysis, because risk events are intuitively against the basic assumption of technical analysis, which market effectively reflects all information. Therefore, overall, seven or eight weeks may not be sufficient to assert that one method is superior to the other.

Figure 4.1 Total Value Comparison
Chapter 5: Conclusion

In Conclusion, our stock market simulations were not quite successful for the following reasons:

First, the market violates under events that are not truly reflected in the past historical data. As we all know, the US stock market has been in a bull market for years before 2019. However, this trend is reversed this year, and especially this summer. Events like a rate cut, G20, the rising tension in specific regions like Iran, Korean, Japan, Hong Kong, trade conflict, US debt, indicate the slowing world economy, and more importantly a turning points of US stock market. This makes technical trading gradually losing its effectiveness in the stock market.

Second, both of us were lack of risk strategies. In the first simulation, we were trying to hold SQQQ, an ETF that shorts the NASDAQ index for half of the time. That is not a wise decision to make. A wrong decision like that happened more than once. It's hard to manage risk without a clear principle and strategies. Also, factors like risk tolerance, risk strategies, and slippage contributed our total lost. We will keep that in mind in the future.
References


“How To Use The Relative Strength Index (RSI).” INO.com Trader's Blog,
www.ino.com/blog/how-to-use-the-relative-strength-index-rsi/?techblog121213#.XOqO

MgzY2w.
Appendix A: Python Code for Moving Average

```python
from datetime import datetime
import datetime as dt
import matplotlib as mpl
import matplotlib.pyplot as plt
import pandas as pd
import pandas_datareader.data as web
import pyEX as p

def setDay(year, month, date):
    Day = dt.datetime(year, month, date)
    return Day

def ImportYahoo(ticker, start, end):
    df = web.DataReader(ticker, 'yahoo', start, end)
    return df

def writeInCSV(dataframe, ticker):
    today = datetime.today()
    csvName = ticker + '.csv'
    print(csvName)
    dataframe.to_csv(csvName)
```
def getStockData(ticker, start = setDay(2015,1,1), end = datetime.today()):
    df = ImportYahoo(ticker, start, end)
    #writeInCSV(df, ticker) Mute this line to save some time
    print(ticker)
    return df

def getMavgPlot(tickerName,df, mavg1, mavg2, mavg3):
    style.use('ggplot')
    plt.figure(figsize=(16,9))
    plt.plot(df.index, df, label=tickerName)
    plt.plot(mavg1.index, mavg1, label='mavg1')
    plt.plot(mavg2.index, mavg2, label='mavg2')
    plt.plot(mavg3.index, mavg3, label='mavg3')
    plt.legend()
    plt.show()

def MovingAverage(stockName, df, day1, day2, day3):
    df = df[["Close"]]
    mavg1 = df.rolling(window=day1).mean()
    mavg2 = df.rolling(window=day2).mean()
    mavg3 = df.rolling(window=day3).mean()
    getMavgPlot(stockName, df, mavg1, mavg2, mavg3)

dfs = []

start_date = dt.datetime(2015,1,1)
#end_date = dt.datetime(2019,6,1)
tickers = ['UBER', 'NFLX', 'DHR', 'ULTA', 'CHDRF', 'TVIX', 'TQQQ', 'SQQQ', 'UPRO', 'SPXS']

for stock in tickers:
    dfs.append(getStockData(stock, start_date)) #store the dataframes in the dfs[]

print(dfs[0].columns.values)

i = 0

while i < len(dfs):
    MovingAverage(tickers[i], dfs[i], 10, 50, 100)
    i += 1
Appendix B: Python Code for LSTM model

```python
!pip install tensorflow
!pip install keras
!pip install sklearn
!pip install numpy

import time
import math
from keras import optimizers
from keras.models import Sequential
from keras.layers.core import Dense, Dropout, Activation
from keras.layers.recurrent import LSTM
import sklearn
import numpy as np

from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split

df = getStockData('UPRO', start = setDay(2010,1,1), end = datetime.today()) #Use UPRO as an example

TIME_STEPS = 3
BATCH_SIZE = 20

def build_timeseries(mat, y_col_index):
    # y_col_index is the index of column that would act as output column
    # total number of time-series samples would be len(mat) - TIME_STEPS
    dim_0 = mat.shape[0] - TIME_STEPS
    dim_1 = mat.shape[1]
```
x = np.zeros((dim_0, TIME_STEPS, dim_1))
y = np.zeros((dim_0,))

for i in range(dim_0):
    x[i] = mat[i:TIME_STEPS+i]
    y[i] = mat[TIME_STEPS+i, y_col_index]
print("length of time-series i/o",x.shape,y.shape)
return x, y

def trim_dataset(mat, batch_size):
    ""
    trims dataset to a size that's divisible by BATCH_SIZE
    ""
    no_of_rows_drop = mat.shape[0]%batch_size
    if(no_of_rows_drop > 0):
        return mat[:-no_of_rows_drop]
    else:
        return mat

x_t, y_t = build_timeseries(x_train, 3)
x_t = trim_dataset(x_t, BATCH_SIZE)
y_t = trim_dataset(y_t, BATCH_SIZE)
x_temp, y_temp = build_timeseries(x_test, 3)
x_val, x_test_t = np.split(trim_dataset(x_temp, BATCH_SIZE),2)
y_val, y_test_t = np.split(trim_dataset(y_temp, BATCH_SIZE),2)

train_cols = ["Open","High","Low","Close","Volume"]
df_train, df_test = train_test_split(df, train_size=0.8, test_size=0.2, shuffle=False)

print("Train and Test size", len(df_train), len(df_test))

# scale the feature MinMax, build array
x = df_train.loc[:,train_cols].values
min_max_scaler = MinMaxScaler()
x_train = min_max_scaler.fit_transform(x)
x_test = min_max_scaler.transform(df_test.loc[:,train_cols])

lstm_model = Sequential()
lstm_model.add(LSTM(100, batch_input_shape=(BATCH_SIZE, TIME_STEPS, x_t.shape[2]),           dropout=0.0, recurrent_dropout=0.0, stateful=True,           kernel_initializer='random_uniform'))
lstm_model.add(Dropout(0.5))
lstm_model.add(Dense(20,activation='relu'))
lstm_model.add(Dense(1,activation='sigmoid'))
optimizer = optimizers.RMSprop(lr=0.0001)
lstm_model.compile(loss='mean_squared_error', optimizer=optimizer)

your_epochs = 300
history = lstm_model.fit(x_t, y_t, epochs=your_epochs, verbose=2, batch_size=BATCH_SIZE,
                         shuffle=False, validation_data=(trim_dataset(x_val, BATCH_SIZE),
                         trim_dataset(y_val, BATCH_SIZE)))

y_pred = lstm_model.predict(trim_dataset(x_test_t, BATCH_SIZE), batch_size=BATCH_SIZE)
y_pred = y_pred.flatten()
y_test_t = trim_dataset(y_test_t, BATCH_SIZE)
error = mean_squared_error(y_test_t, y_pred)
print("Error is", error, y_pred.shape, y_test_t.shape)
print(y_pred[0:15])
print(y_test_t[0:15])
y_pred = (y_pred * min_max_scaler.data_range_[3]) + min_max_scaler.data_min_[3] #
min_max_scaler.inverse_transform(y_pred)

y_test_t_org = (y_test_t * min_max_scaler.data_range_[3]) + min_max_scaler.data_min_[3] #
min_max_scaler.inverse_transform(y_test_t)

print(y_pred_org[0:15])
print(y_test_t_org[0:15])

plt.figure()
plt.plot(y_pred_org)
plt.plot(y_test_t_org)
plt.title('Prediction vs Real Stock Price')
plt.ylabel('Price')
plt.xlabel('Days')
plt.legend(["Prediction", 'Real'], loc='upper left')