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Stock Market Simulation

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Mechanical Engineering

By

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Abstract

The objective of this project was to examine the nature and history of the stock market and compare the implementation of two different investment strategies in a trading experiment. Two simulated investment accounts were used in the four-week experiment; one following a passive “buy and hold” strategy and another following a more active strategy relying on technical analysis. At the end of the experiment, the buy and hold account had a return of -13.4% and the technical analysis account had a return of -2.8%. Although both accounts lost value, the more active strategy outperformed the passive strategy as well as the general market in all metrics. Though passive investment strategies are generally considered the better option for long-term growth, this research indicated that active investing strategies could outperform passive strategies, particularly in bear markets.

Acknowledgments

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Chapter 1: Introduction

1.1 Goals

The primary goal of this project was to develop an understanding of how the stock market operates while using this knowledge to test and analyze the viability of different trading theories. The history of the stock market and its historic crashes provided a foundation for this research. Studying the fundamental purpose and operation of the stock market created a framework for the project. Identifying and employing market research tools was the mechanism to interact with and analyze the project data. Utilizing various resources to research individual stocks along with market history, conditions, indexes, and indicators, resulted in an increased comprehension of the metrics and behaviors of the market.

In this research, two unique trading strategies were selected and implemented in a four-week, parallel investing experiment, and the analysis of these opposing strategies revealed both their inherent and resulting strengths and weaknesses. A simulated transaction of $100,000 was invested in a select group of assets. Weekly, real-time trades were made by following each unique strategy, and separate records were kept for comparison and research. The resulting analysis informed the viability and potential success of future trading strategies. At the conclusion of the experiment a final, comprehensive analysis was performed to determine the overall effectiveness of each strategy.

1.2 Understanding the Stock Market

The stock market exists as an exchange for companies and institutions to raise capital, and for investors to realize profits. The stock market broadly refers to a number of exchanges and venues in which shares of publicly held companies are bought and sold. Traders in the stock market buy or sell shares on one or more of the stock exchanges that are part of the overall stock market. The leading U.S. stock exchanges include the New York Stock Exchange (NYSE) and the Nasdaq, which have a market capitalization of $27.21 trillion and $22.42 trillion respectively, making them the largest stock exchanges in the world [1]. Figure 1.1 lists the top exchanges by market capitalization. In the United States, stock exchanges are regulated by the federal government through the U.S. Securities and Exchange Commission [2].

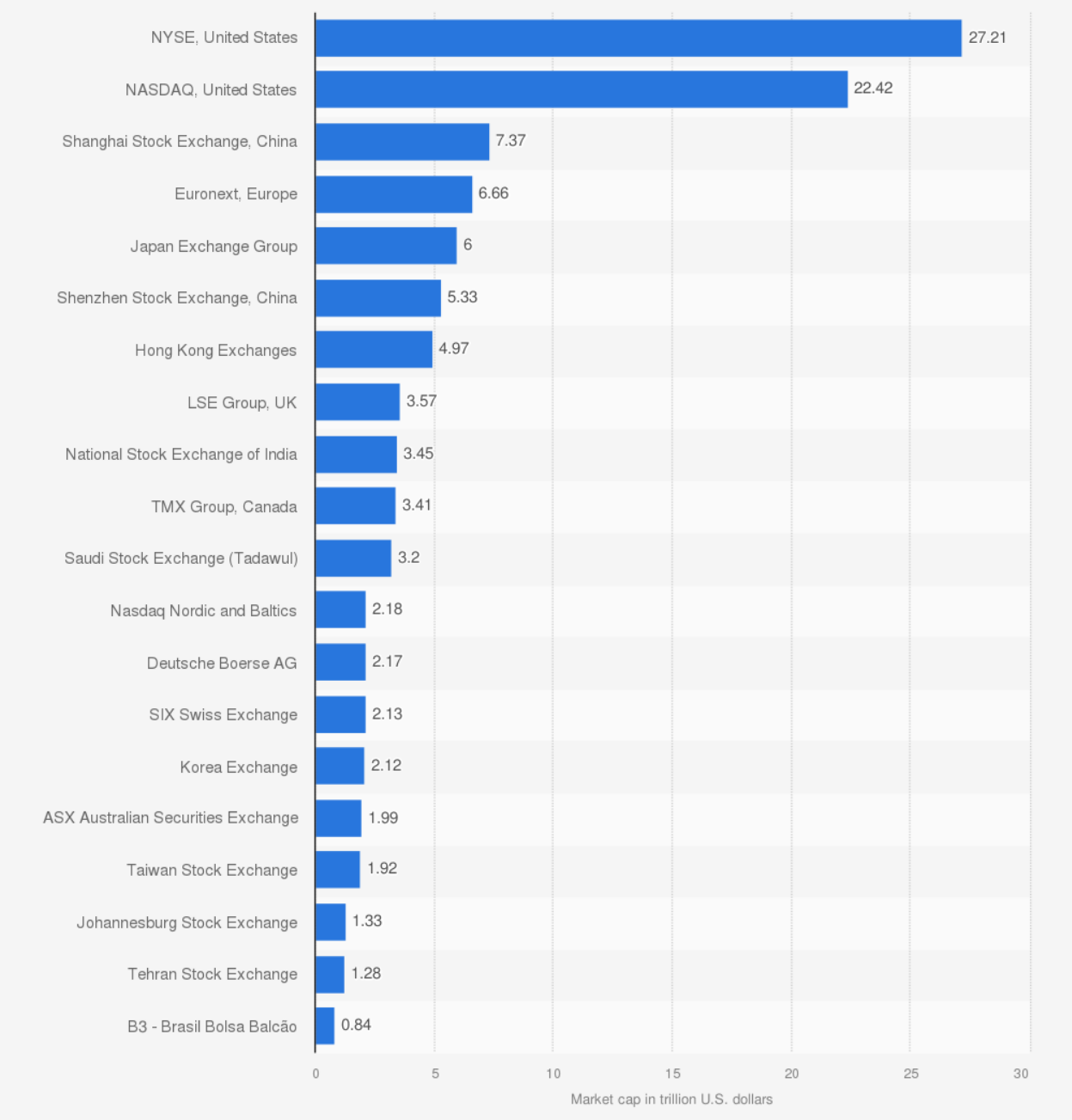

Figure 1.1: Largest Stock Exchanges by Market Capitalization worldwide as of March 2022.

Generally, a security is any financial asset that can be traded; and publicly traded securities are classified into three trade categories: equity securities, debt securities, and derivatives [3]. Equity securities, which include stocks and ETFs, represent ownership in a corporation. This ownership entitles the holder to a portion of net assets, voting rights, and, in

some cases, dividends [4]. Return on investment is dependent on market performance, and thus carries risk and has no guarantee of profit. Debt securities are debts that can be bought and sold and are issued by corporations or governments. The buyer of the debt security is essentially lending money to the issuer in exchange for regular interest payments plus the return of the full principal amount upon maturity [5]. Debt securities include U.S. Treasury bills, bonds, notes, and certificates of deposit (CDs) [5]. Return on investment is largely predetermined by interest rate and maturity date, making debt securities a low-risk investment. Lastly, derivative securities, such as options and futures, are securities or contracts giving the buyer the right, but not necessarily the obligation, to buy or sell an asset at a set price on or before a specific date [6]. The value of these investments is based on or "derived" from the underlying securing asset. Derivatives are volatile and the contracts are complex, making them a speculative, higher-risk investment.

The health of the U.S. economy is often measured by the performance of the stock market. As part of this system, a stock exchange has a responsibility to ensure price transparency, liquidity, price discovery, and fair dealings [2]. The integrity of the stock market is important to capitalist and free market economies, as it is a key to encouraging corporate growth and investor income, and in creating and trading wealth [7].

1.3 History of the Stock Market

The concept of buying and selling equity has its formal origins in the trading voyages of the 1600s, and the Dutch East India Company was the first to issue stocks to public investors through the Amsterdam Stock Exchange in 1602. Previously, Britain, France, and the

Netherlands extended royal charters to explore and trade in the East Indies, yet few merchants could afford the exorbitant cost of these ventures. In answer, limited liability companies (LLCs) were created to fund these trade expeditions by selling shares in the voyages in return for a portion of any profits. With this model, significant capital could be raised while spreading out risks and sharing rewards [8].

In the United States, the Philadelphia Stock Exchange opened seven years after the Revolutionary War and the New York Stock Exchange (NYSE) soon followed in 1792 [9]. In 1971, NASDAQ was formed and was the first exchange to trade securities electronically via a network of computers rather than operating out of a physical location, forcing the innovation of how securities were traded [9]. The World Federation of Exchanges now lists 80 exchanges worldwide, representing 58,200 companies and $122.94 trillion in stock market capitalization [10].

1.4 Historic Market Crashes

A stock market crash occurs when the market loses substantial value in a short amount of time. A crash is typically identified by a double-digit loss of value within the major market indexes, accompanied by the panic-selling of stocks by investors attempting to stem their losses [11]. Several economic factors can contribute to a crash of the market including extreme overvaluation of stocks, changes in federal regulations, an overinflated economy, natural disasters, sociopolitical events like war, and extensive use of margin trading [11]. Ultimately, fear and subsequent panic-selling are the most basic triggers of a market crash. And while a

stock market crash can be abrupt and brief, the effects can create enduring issues for investors, economies, and even nations.

America's first great economic depression, the Panic of 1819, lasted two years and resulted from a collapse of cotton prices, credit contraction, and over-speculation. Then followed a series of crashes every few decades. The Panic of 1837 was due to a real estate bubble, the Panics of 1857 and 1884 stemmed from large bank failures, and the severe Panic of 1893 resulted from panic-selling during a run-on gold in the U.S. Treasury [11].

Notable as the first financial crisis of the 20th century to extend across the world, the Panic of 1907 ensued when speculators attempted to corner the stock of United Copper. Their failure produced a run on the associated banks, which then failed after losing all deposits. The panic spread to other banks causing a severe collapse of market liquidity [11]. J.P. Morgan and others intervened to rescue the banks and subsequently the stock market. The Panic of 1907 was the impetus for the formation of the U.S. Federal Reserve System [12].

Preceding the infamous 1929 stock market crash, the United States experienced a period of significant market prosperity. As Williams notes, ‘The boom had been spurred by everyday people buying stock with borrowed money, and the stocks serving as collateral for the loans’ [12]. The Dow Jones Industrial Average (DJIA) grew from 63 to 381 in five years [11]. This rampant speculation and margin buying coupled with public utility stock inflation created a very unsteady bubble. On October 28, 1929, Black Monday, the market crashed 13 percent and continued falling for almost three years until the summer of 1932. By then the Great Depression was entrenched, the market had lost 90 percent of its value, and recovery did not resolve until 1954, 25 years later [13].

Another Black Monday took place on Oct. 19, 1987, when the DJIA plunged 22.6%. This was the largest one-day stock market decline in history [11]. The crash stemmed from a torrent of bad news, including an extensive trade deficit and falling dollar value, along with an increase in international investors and the use of options and derivatives. It was preceded by an increase of 44% in value [12]. Asia, New Zealand, Australia, Hong Kong, Singapore, and Mexico also suffered crashes revealing the global connection of modern markets [11]. In the years that followed, regulators introduced reforms to address the structural flaws that allowed Black Monday to occur, and the first circuit breakers were also put in place so that exchanges could halt trading temporarily in instances of exceptionally large price swings.

With the rapid growth of the internet and related technology start-ups in the 1990s, investors became enamored and speculated heavily in the technology sector. 'During this period, several new firms came into being, most of which never generated any profit' [11]. The hype fueled a 500% increase in Nasdaq between 1995 and 2000 [12]. This "dot-com" bubble burst on March 10, 2000 [12]. During the subsequent crash, the market lost 77% of its value and did not fully recover until 2015 [13].

As described by the Chicago Tribune, '[In 2008] at the core of the Great Recession, a housing crash hit the United States spurred by lax lending practices to those with little ability to repay' [12]. An energized mortgage market drew $1 trillion in new funds but ultimately collapsed when large quantities of these mortgages went into default. As these residential home foreclosures surged, the unemployment rate escalated. The resulting crash took down the massive lending establishments of Fannie Mae, Freddie Mac, and Lehman Brothers, while the S&P 500 fell 57% [13]. To stall the free-fall, the U.S. Treasury Department nationalized Fannie Mae and Freddie Mac and approved a bailout package to protect the U.S. financial system [11].

Studying the historic crashes of the U.S. stock market provides a broad record of its nature and trajectory. The U.S. stock market has trended upward over history. The chart in Figure 1.2 shows that over this period of almost 150 years, $1 (in 1870 U.S. dollars) invested in a hypothetical U.S. stock market index in 1871 would have grown to $18,500 by the end of June 2020 [14]. The chart also illustrates the natural capacity of the markets to self-correct after periods of over-speculation and inflated growth, or periods of depression. History reveals that the market is never smooth, and some of its drops are severe; yet, while market crashes occur with routine frequency, the market always rebounds. This knowledge informs investment influences, markers, risk, and potential.

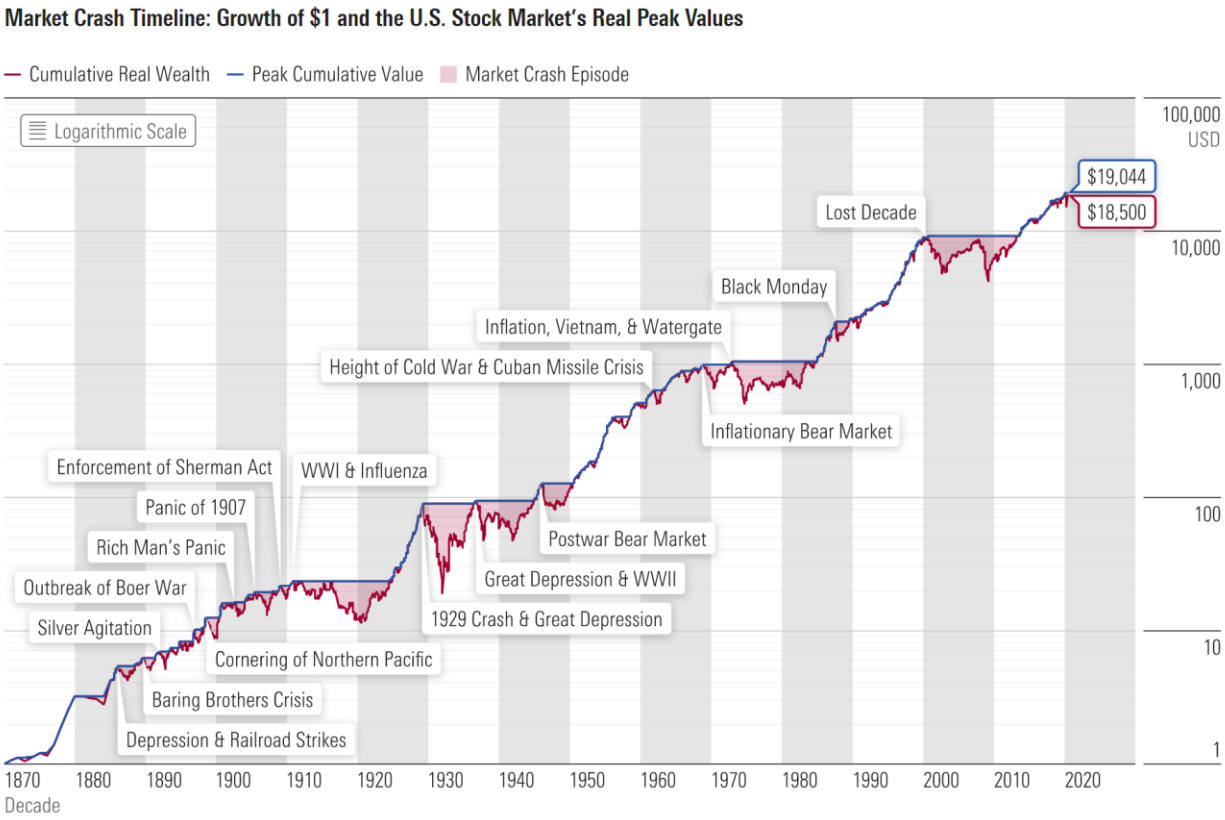

Figure 1.2: U.S. Market Performance with Crashes and Notable Events

1.5 Factors and Influences of The Stock Market

As with any economic vehicle, the stock market is influenced by several factors. Governments hold a large amount of power over the stock market, and their decisions can sway the market. Fiscal and monetary policies enacted by governments have a major effect on the stock market. By increasing or decreasing monetary supply, interest rates, and tax rates, governments influence the demand for stocks. For example, if the monetary supply in a country is lowered, and the interest rate and tax rate are raised, then there will be less capital available to be invested in the market. This will lower the demand for shares and assets and thus drive prices down [15].

International transactions also can have a profound impact on a country's market. Countries that are net exporters are continuously selling goods and services while bringing in capital. Those funds can then be invested into that county's markets, which increases demand and drives stock prices higher [15].

The stock market is inherently speculative in nature. Speculations about the performance of large companies can impact entire markets. Speculation about future economic conditions also plays a major role in stock market trends. Global concerns such as the Covid-19 Pandemic can cause investors to be wary about economic conditions and invest less money in the market. Presidential elections and proposed changes in spending or tax policy also generate a large amount of volatility [15].

1.6 Stock Market Indexes

Measuring market performance is key to economic understanding, engagement, and success. An index is a tool used to track and measure the performance of a group of assets within the market. Indexes typically measure the market performance of several related assets using a standardized metric. They are also used to measure other economic data such as inflation, interest rates, volatility, etc. In the stock market, indexes consist of a hypothetical portfolio of assets that represent a specific market or market segment, and each index has its unique method of calculation. The value of an index typically starts at a predetermined base level at its creation and then will either rise or fall in value depending on the performance of the assets that comprise it. For this reason, the relative change of an index's value is more important than the actual value of the index [1]. Figure 1.2 depicts a graphical representation of the individual securities that make up the S&P 500, one of the most popular indexes. The size of the rectangles corresponds to the percentage of the index that security comprises.

Figure 1.3: Visualization of The S&P 500

The performance of popular indexes such as the S&P 500, the NASDAQ 100, and the Dow Jones Industrial Average are often used as benchmarks of the U.S. stock market. They represent large U.S. companies and capture a great portion of the total capitalization of the U.S. market. Therefore, they serve as good indicators of general market trends.

Chapter 2: Experiment Methodology

2.1 Simulation Platform

Building on the study of the history and operation of the stock market, research tools and investment strategies were chosen to begin the market simulation experiment. To conduct this experiment, a simulated broker was necessary. TradingView was utilized as the simulated broker for this project as it employs a large collection of technical analysis tools and is one of the most widely used platforms for developing and testing trading strategies. TradingView tracks market data on a myriad of stocks, indexes, and other assets. It offers users the ability to open a "paper" account, in this case containing a simulated balance of $100,000 USD. This balance can then be used to make simulated trades on any of the assets TradingView lists. The simulated trades are high fidelity, meaning the orders are not instantaneous and may fail to fill completely. These risks are present when trading with real funds, so it is important that they were also present in the simulation. Reproduced for two different trading strategies, TradingView's paper trading feature was used to make simulated trades with the artificial balance, while keeping track of the results.

2.2 Investment Strategies

2.2.1 Buy and Hold

The first investment method to be tested, "buy and hold" is a simple, passive investment strategy in which an investor buys stocks or other assets and holds them for an extended period of time. An investor using this strategy selects stocks and assets they believe will increase in value in the long run but has little to no concern with short-term price movements. Once the asset has appreciated beyond the target the investor has set, the asset can be sold for profit. One

advantage of holding assets for a long period of time is that capital gains taxes can be deferred, as any gain in value is not realized until the asset is sold [4].

2.2.2 Technical Analysis

The second investment strategy chosen for this experiment, technical analysis is a method of trading used to evaluate investments from a statistical, trend-based approach. Technical analysis is based on the theory that the past trading activity and price swings of a security can be useful predictors of the future performance of that security. It evaluates current and historical prices and volume to predict future prices and volume. As defined by Battle,

> Technical analysis can be applied to any security with historical trading data. This includes stocks, futures, commodities, fixed-income, currencies, and other securities. In fact, technical analysis is far more prevalent in commodities and forex markets where traders focus on short-term price movements [16].

Technical analysis theory is contingent on two basic assumptions. The first is that markets are efficient, with the values of securities being representative of the factors that influence the prices of securities. The second is that even random market price moments form identifiable patterns and trends that repeat over time.

2.3 Data Analysis Method

2.3.1 Fundamental Analysis

When choosing which individual stocks to trade within both strategies, fundamental analysis was utilized. Fundamental analysis is a method of measuring the intrinsic value of a security by examining its related financial and economic factors. Fundamental analysis looks at several factors that might influence the value of a security. These include the overall state of the

economy, the strength within the industry of the security, and the performance of the company the security represents [17]. The goal of fundamental analysis is to determine a fair current or future market value for a security. This information can then be used to make a profit on that security. For example, if a fundamental analysis determines that an asset is undervalued in the current market, then an investor may buy the security expecting that it will increase in value.

2.3.2 Technical Analysis

When experimenting using a technical analysis trading strategy, Bollinger Bands and the Moving Average Convergence/Divergence (MACD) were the two primary indicators used. Bollinger Bands are a type of price envelope developed by John Bollinger [18]. A price envelope is used to define upper and lower price range levels for a security. Bollinger Bands are calculated by first determining a simple moving average (SMA) of the price of a security. A standard deviation of the SMA is then taken to calculate the values of the upper and lower bands. The upper band is calculated by adding the standard deviation to the SMA, while the lower band is calculated by subtracting the standard deviation from the SMA. Bollinger Bands require two parameters: the SMA period and the number of standard deviations. Figure 2.1 depicts upper and lower Bollinger Bands applied to an asset at two standard deviations.

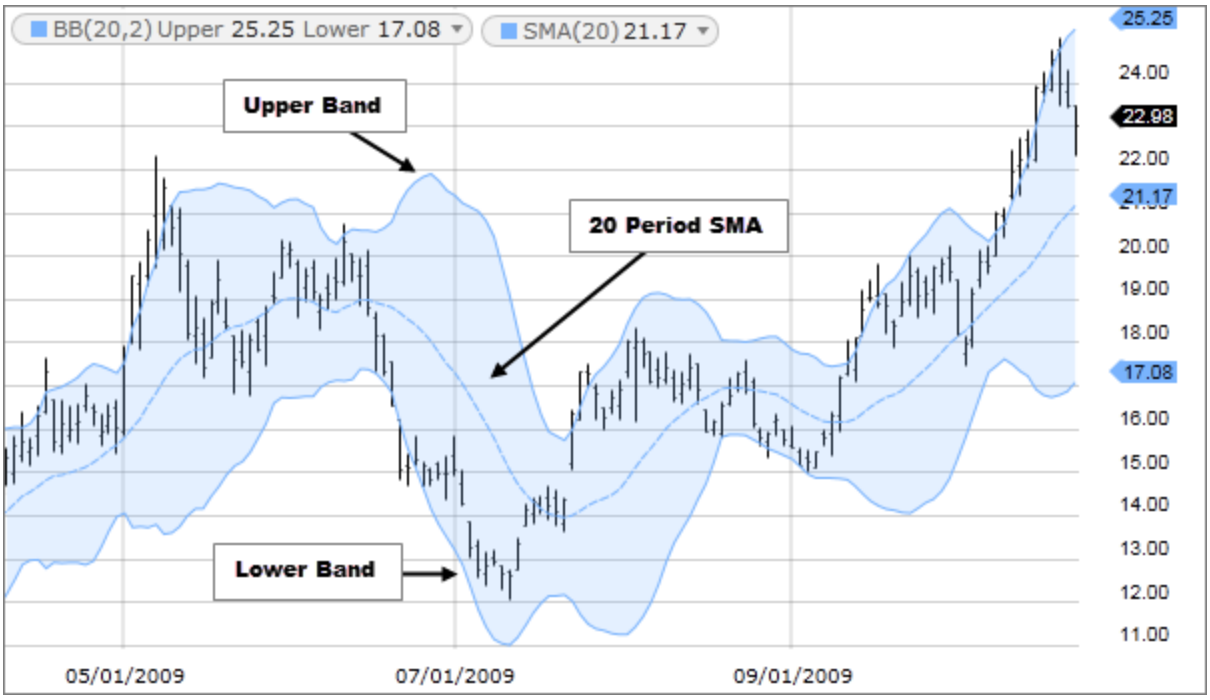

Figure 2.1: Bollinger Bands (20 Period SMA, 2 StdDev)

Bollinger Bands have a few different uses. When the bands tighten during a period of low volatility, it raises the likelihood of a sharp price move in either direction. This may begin a trending move [18]. If the bands separate by an unusually large amount, the converse is true. Volatility increases and an existing trend may be coming to an end.

Prices also tend to bounce between the bands or hug one of the bands. This can be used to identify possible profit targets and entry points. For example, if the price moves from the top band and crosses the SMA line, then the lower band may be a potential entry point. Figure 2.2 displays examples of this price behavior.

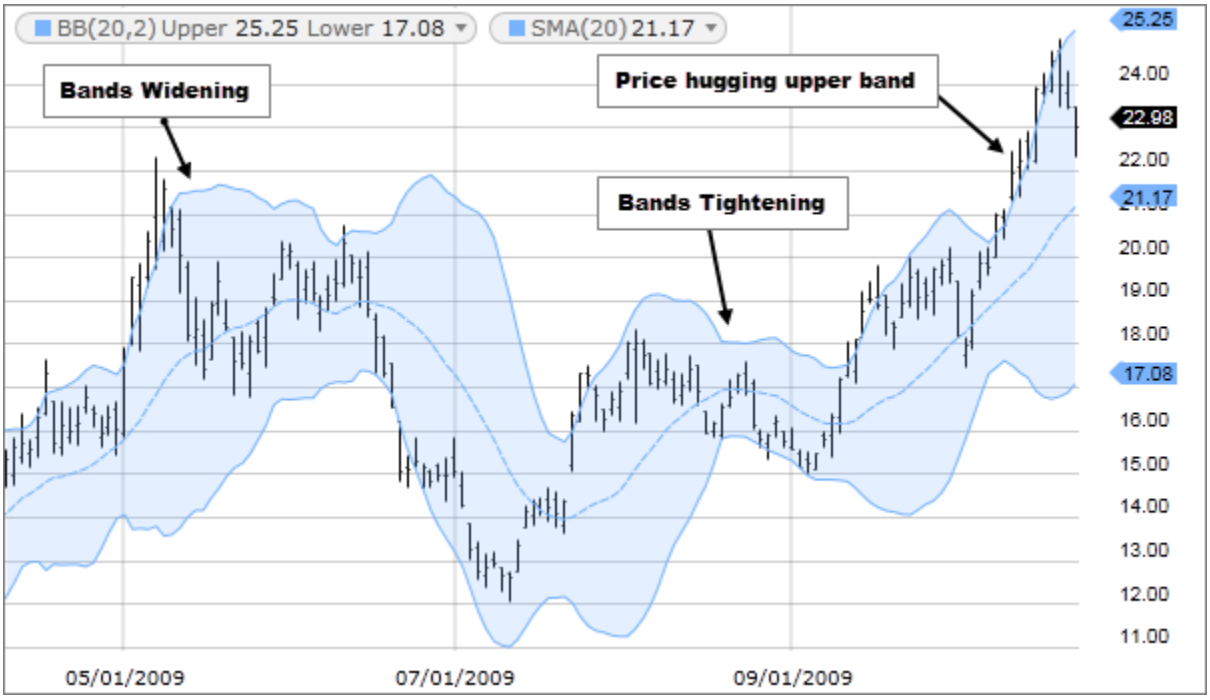

Figure 2.2: Example of Price Behavior in Relation to Bollinger Bands Activity

The Moving Average Convergence/Divergence (MACD) is a momentum-based oscillator. It is primarily used to trade trends [19]. It appears on a chart as two lines: the MACD line and the signal line. When the MACD line crosses above the signal line the security is considered bullish. When the MACD line crosses below the signal line, the security is considered bearish. The farther above or below the signal line the MACD is, the more bullish or bearish the security is considered to be. The difference between the signal line and the MACD line is typically plotted on a histogram for easier visualization. The MACD line can be approximated by subtracting the value of the 26-period Exponential Moving Average (EMA) from the 12-period EMA. The signal line is calculated by taking a 9-period EMA of the MACD line. As seen in Figure 2.3, when the MACD line crosses the signal line, it is a good indicator of bullish price movement.

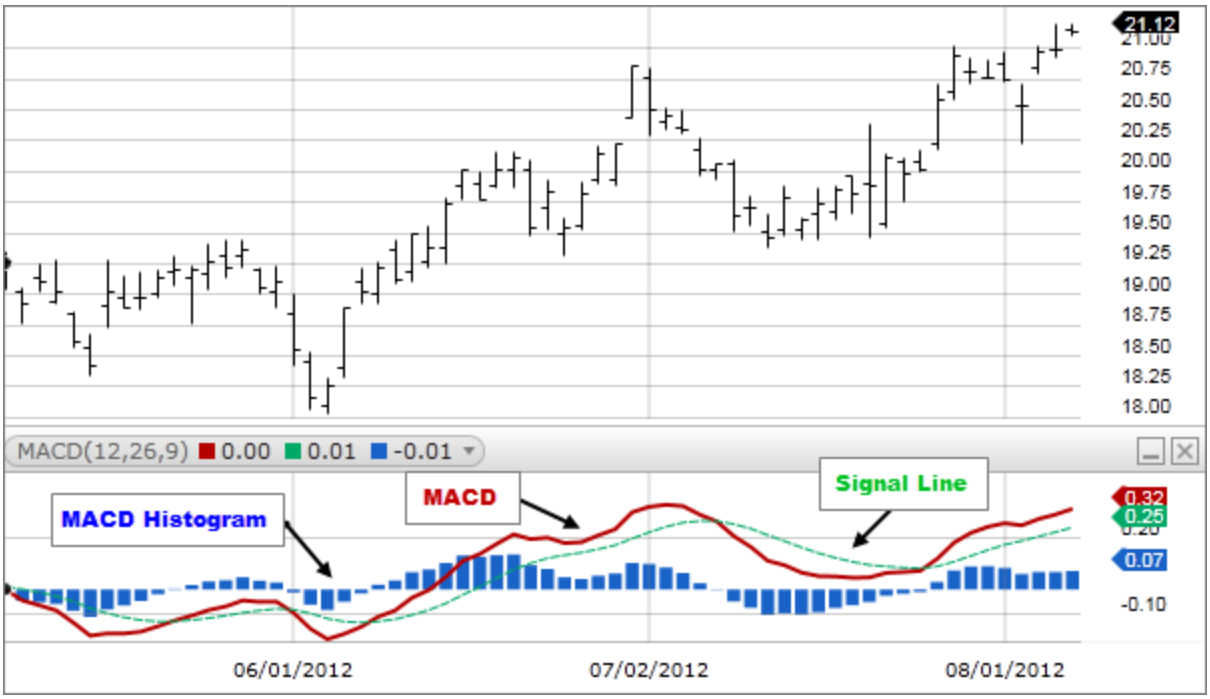

Figure 2.3: Example of MACD Indicator

2.3.3 Analytical Comparison of Trading Results

The results of each trading strategy were compared using a few different methods. The primary method of comparison was the total profit/loss obtained during the trading period, expressed as a percentage. This is the most important value to compare because earning and maintaining a profit is the primary goal of an investor. The maximum drawback of each strategy was also compared as an indicator of volatility and risk. Graphs and tables of total asset value were also used to analyze the relative volatility and risk of each strategy.

2.4 Assets Selected

2.4.1 Camping World Holdings, Inc. (CWH)

Camping World Holdings, Inc. is a U.S. corporation specializing in selling recreational vehicles and camping gear. They are America's largest retailer of RVs and related products and

services. Due to the turbulent markets over the past few months, the share value of CWH has dropped substantially. Despite this, CWH still has very strong fundamentals. Quarterly revenue growth is above 20%, and operating income is up almost 80% over the last quarter [20]. During the last quarter, the company repurchased over 2.5 million shares through an aggressive stock buyback program [21]. Putting all of this together indicates that the stock is extremely undervalued and is likely to rebound in the near future.

2.4.2 Walt Disney Company (DIS)

The Walt Disney Company is a powerhouse in the entertainment industry. They operate a wide range of subsidiary media companies including ESPN, Pixar, Marvel, Lucasfilm, ABC Television, and 20th Century Fox. This being the first summer since the Coronavirus Pandemic puts Disney on pace to increase its revenue substantially as its parks reopen and as cinemas see patronage return to pre-Covid levels. Shares of DIS are currently at approximately 50% of their all-time high. This theoretically creates a great opportunity to purchase the stock at a discount.

2.4.3 VanEck Gold Miners ETF (GDX)

The VanEck Gold Miners ETF is an exchange-traded fund that gives investors exposure to gold mining companies [22]. It is composed of 53 companies with $12.6 billion in total assets as of June 1, 2022 [22]. Figure 2.4 displays that the ETF has pulled back approximately 20% from its April high.

Figure 2.4: GDX Price Chart (4h Candles)

Comparing GDX with the price of gold in Figure 2.5 reveals that GDX price movements tend to closely mirror the gold price. Gold is generally viewed as a “safe haven” investment that often contradicts the market as investors flock to it during economic downturns. Assuming inflation in the U.S. continues to rise and the current bearish cycle will continue, we would expect the price of GDX to increase along with the price of gold.

Figure 2.5: Gold Spot Price Per Oz (4h Candles)

Chapter 3: Buy and Hold

3.1 Simulation

3.1.1 Week 1 (06/06-06/11)

Going into the first week of the experiment, the market was slightly up from its previous lows. Both the S&P 500 and the NASDAQ reclaimed about 6% over Wednesday through Friday as seen in Figure 3.1 and Figure 3.2, bringing an end to seven consecutive weekly declines. This came after the release of minutes from the Federal Reserve's latest meeting, which signaled expectations of more interest rate hikes. These rate hikes would be implemented to curb rising inflation rates. However, increasing interest rates may also slow economic growth to the point where the U.S. enters a recession [23]. The personal consumption index (PCE), a key measure of U.S. inflation, rose by only 0.2% in April. This is the smallest increase in over a year and may signal that U.S. inflation is slowing.

Figure 3.1: S&P 500 Index Chart Leading Up to Week 1

Figure 3.2: NASDAQ Composite Index Leading Up to Week 1

On Monday, May 30th, markets were up for the fourth consecutive day. Therefore, the decision was made to wait until the next day to enter the three positions in hopes of obtaining a better entry point. On Tuesday, May 31. markets were down from the previous day, so the decision was made to purchase the three securities: CWH, DIS, and GDX. This account will be following a buy-and-hold strategy throughout the four weeks. It will simply rely on the fundamental analysis conducted previously. Therefore, equal quantities of the three securities were purchased at market prices. They will be held for the rest of the experiment and then be sold on the last trading day.

As viewed in Figure 3.3, CWH trended upward throughout the week and closed 3.4% above the previous week.

Figure 3.3: CWH Price Chart Week 1

As seen in Figure 3.4, DIS fell sharply throughout the week and closed 8.5% below last week's close.

Figure 3.4: DIS Chart Week 1

Figure 3.5 shows the price chart for GDX throughout Week 1. GDX fell at the opening of the week and then recovered back to neutral on Tuesday, June 7th. The security fell lower on Wednesday and Thursday, followed by a sharp increase on Friday. GDX closed at virtually the same price it opened the week with.

Figure 3.5: GDX Chart Week 1

Table 3.1 gives a list of all transactions in Week 1. This account was following a buy and hold strategy, therefore equal amounts of all three securities were purchased on Tuesday, June 7th. These positions were held until the end of the experiment.

Table 3.1: Trading record for Week 1.

Time	Symbol	Buy/ Sell	Qty	Price	Net Cost/ Proceeds	Profit/ Loss	Total Cash
6/6/2022 12:30							$100,000.00
6/7/2022 9:22	CWH	Buy	1139	$ 26.30	$ 29,955.70		$ 70,044.30
6/7/2022 9:34	GDX	Buy	1080	$ 32.45	$ 35,046.00		$ 34,998.30
6/7/2022 9:49	DIS	Buy	324	$ 107.67	$ 34,885.08		$ 113.22

Table 3.2 gives a list of all open positions at the end of Week 1. GDX and CWH were both up slightly, however, the DIS position was down significantly. The "Last Price" is the closing price at the end of the week.

Table 3.2: Open positions at the end of Week 1.

Symbol	Qty	Avg Fill Price	Last Price	Profit	Asset Value
DIS	324	$ 107.67	$ 99.40	($2,679.48)	$ 32,205.60
GDX	1,080	$ 32.45	$ 32.47	$21.60	$ 35,067.60
CWH	1,139	$ 26.30	$ 26.70	$455.60	$ 30,411.30
			Total:	($2,202.28)	$ 97,684.50

3.1.2 Week 2 (06/13-06/18)

Week 2 was a significantly volatile week for the stock market. As seen in Figure 3.6, the NASDAQ opened approximately 3.5% lower than the previous week's close. On Wednesday, June 15th the Federal Reserve made the decision to raise interest rates by 0.75%, followed by another 0.75% hike next month. After the decision, markets reclaimed approximately 4%, however these gains were lost on Thursday. The market closed 4.75% lower than the previous week.

Figure 3.6: NASDAQ Composite Over Week 2

The falling markets and recession fears had a significant impact on the three securities in the buy and hold strategy. As seen in Figure 3.7, CWH closed 14.39% lower than the previous week. As seen in Figure 3.8, DIS closed 8.54% below the previous week. Finally, as seen in Figure 3.9, GDX closed 6.74% lower than the previous week.

Figure 3.7: CWH Price Throughout Week 2

Figure 3.8: DIS Price Throughout Week 2

Figure 3.9: GDX Price Throughout Week 2

Table 3.3 gives a list of all open positions at the end of Week 2. All three positions were down significantly. The fundamentals of the three securities were still strong, but the overall market conditions were driving their prices lower and lower. The hope was that they would rebound, however a one-month timeframe would possibly be too short to experience this.

Table 3.3: Open positions at the end of Week 2.

Symbol	Qty	Avg Fill Price	Last Price	Profit	Asset Value
DIS	324	$ 107.67	$ 94.34	$ (4,318.92)	$ 30,566.16
GDX	1,080	$ 32.45	$ 30.39	$ (2,224.80)	$ 32,821.20
CWH	1,139	$ 26.30	$ 22.81	$ (3,975.11)	$ 25,980.59
			Total:	$ (10,518.83)	$ 89,367.95

3.1.3 Week 3 (06/20-06/25)

Week 3 saw a bit of relief in the market. As seen in Figure 3.10, the S&P 500 gained just under 6.5% that week. Similarly in Figure 3.11, the NASDAQ gained almost 7%. Many Wall Street investors maintained that this gain was likely a short bear market rally correcting strongly oversold conditions [24]. There could have been some additional short-term growth in the following weeks, however the intermediate and long-term outlooks were still negative.

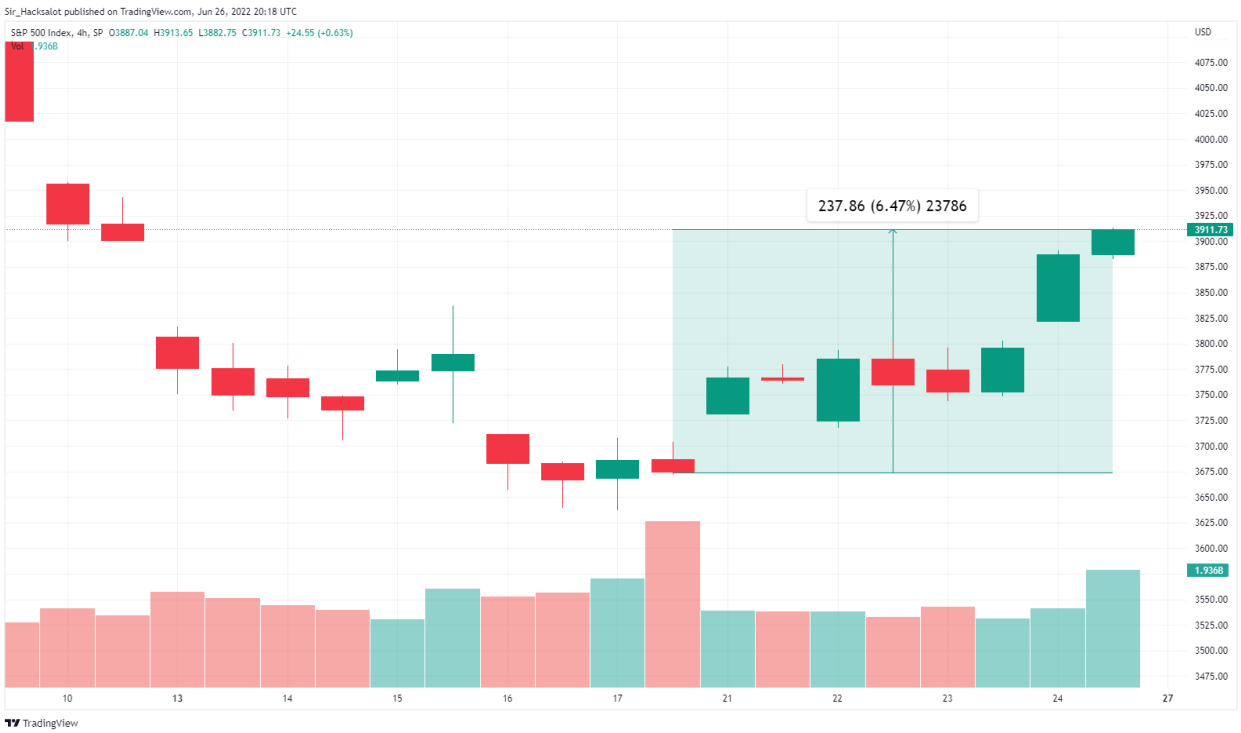

Figure 3.10: S&P 500 Index Over Week 3

Figure 3.11: NASDAQ Composite Over Week 3

Both CWH and DIS appreciated throughout week 3. CWH had a modest gain of about 3.5% as seen in Figure 3.12. DIS also saw a 3.5% gain, driven mostly by a sharp increase on Friday as shown in Figure 3.13. GDX trended lower throughout the week but also had a sharp increase on Friday. Overall, GDX traded about 2.25% down from the previous week as seen in Figure 3.14.

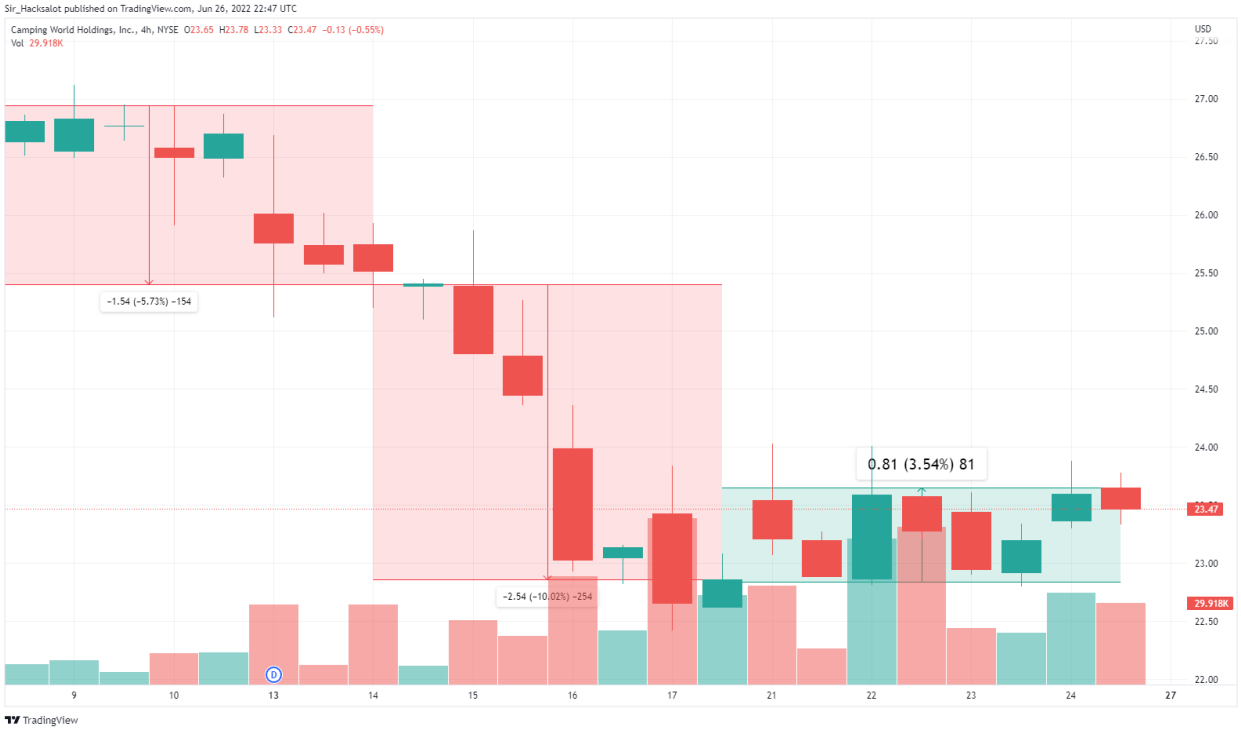

Figure 3.12 CWH Price Throughout Week 3

Figure 3.13 DIS Price Throughout Week 3

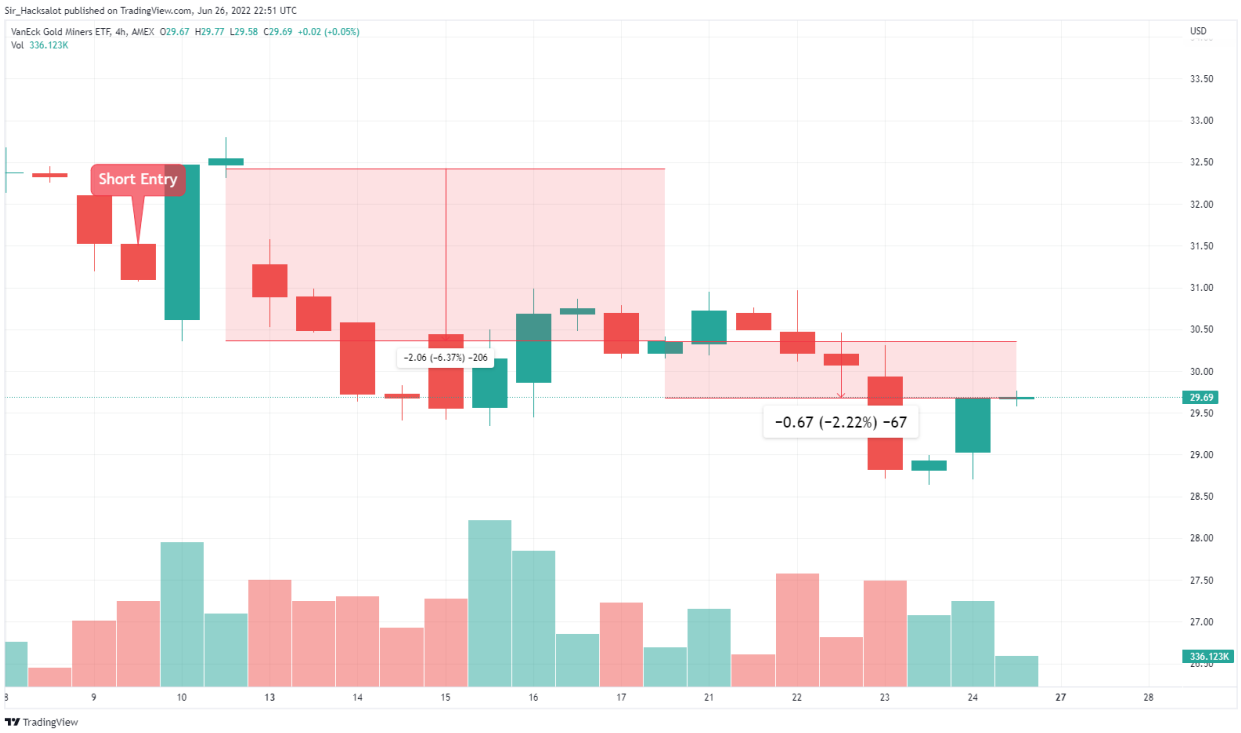

Figure 3.14 GDX Price Throughout Week 3

Table 3.4 gives a list of all open positions at the end of Week 3. DIS and CWH were up slightly from the previous week, and GDX was down slightly from the previous week.

Table 3.4: Open positions at the end of Week 3.

Symbol	Qty	Avg Fill Price	Last Price	Profit	Asset Value
DIS	324	$ 107.67	$ 97.78	$ (3,204.36)	$ 31,680.72
GDX	1,080	$ 32.45	$ 29.66	$ (3,013.20)	$ 32,032.80
CWH	1,139	$ 26.30	$ 23.47	$ (3,223.37)	$ 26,732.33
			Total:	$ (9,440.93)	$ 90,445.85

3.1.4 Week 4 (06/27-07/02)

As predicted, the market resumed its bearish trend in Week 4 after the previous week's rally. As seen in Figure 3.15, the S&P 500 lost approximately 2.2% this week. Similarly in Figure 3.16, the NASDAQ lost 4.3%. Recession fears and lack of market confidence would likely continue to drive the market lower in the coming weeks.

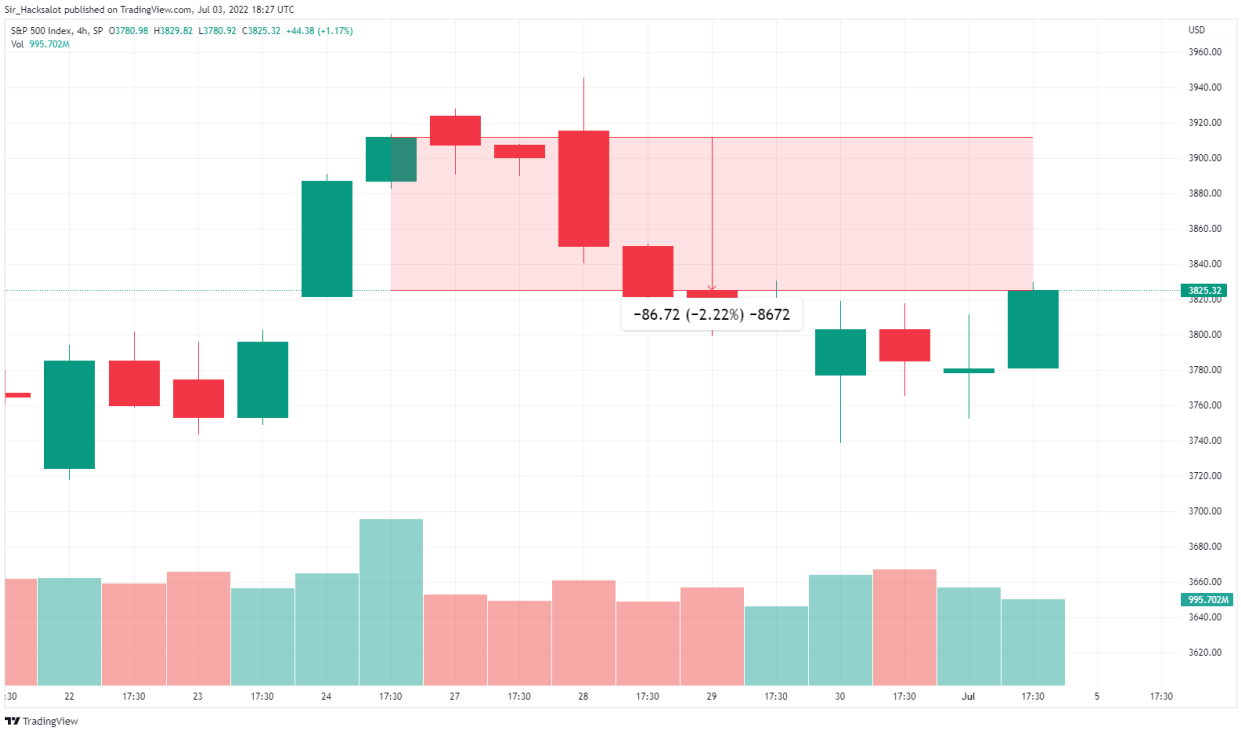

Figure 3.15: S&P 500 Over Week 4

Figure 3.16: Nasdaq Composite Over Week 4

All three of the traded securities had negative performance in Week 4. CWH lost almost 7.3% as seen in Figure 3.17. DIS had a more modest decline of about 1.6% shown in Figure 3.18. GDX trended lower throughout the week but experienced a rally on Friday. Overall, GDX traded about 5.1% lower than the previous week as seen in Figure 3.19.

Figure 3.17: CWH Over Week 4

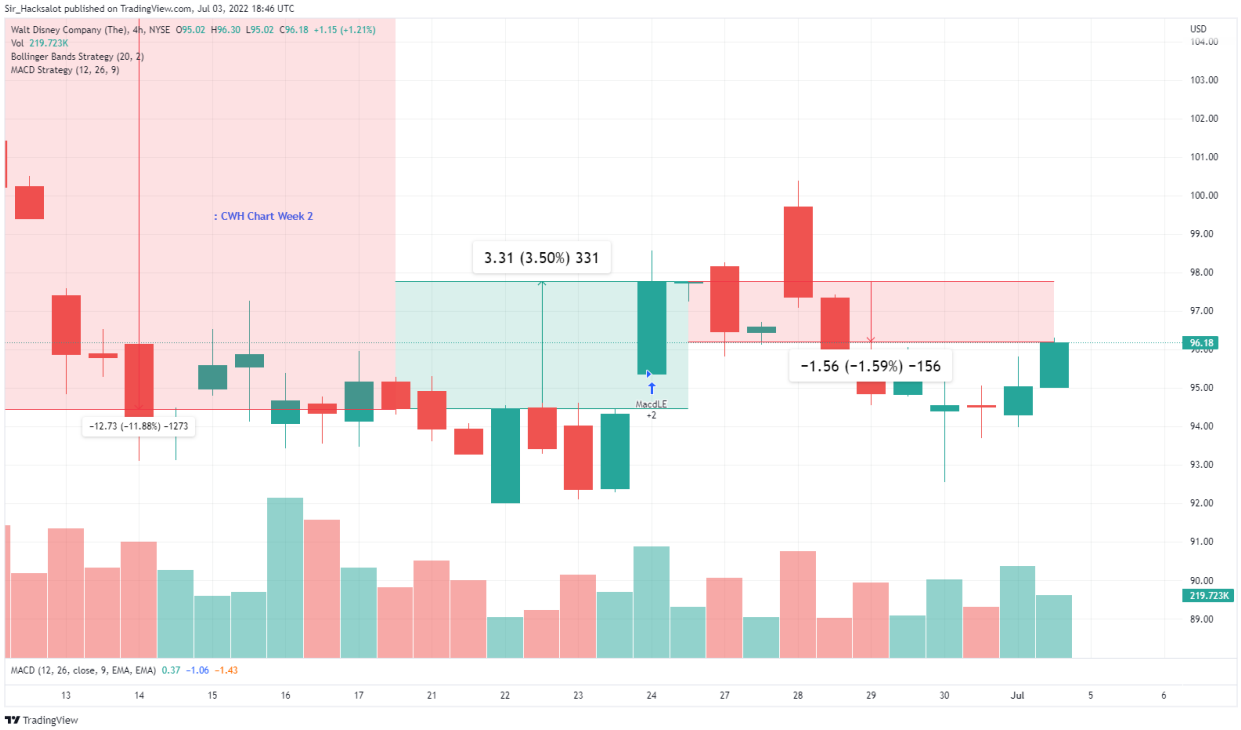

Figure 3.18: DIS Over Week 4

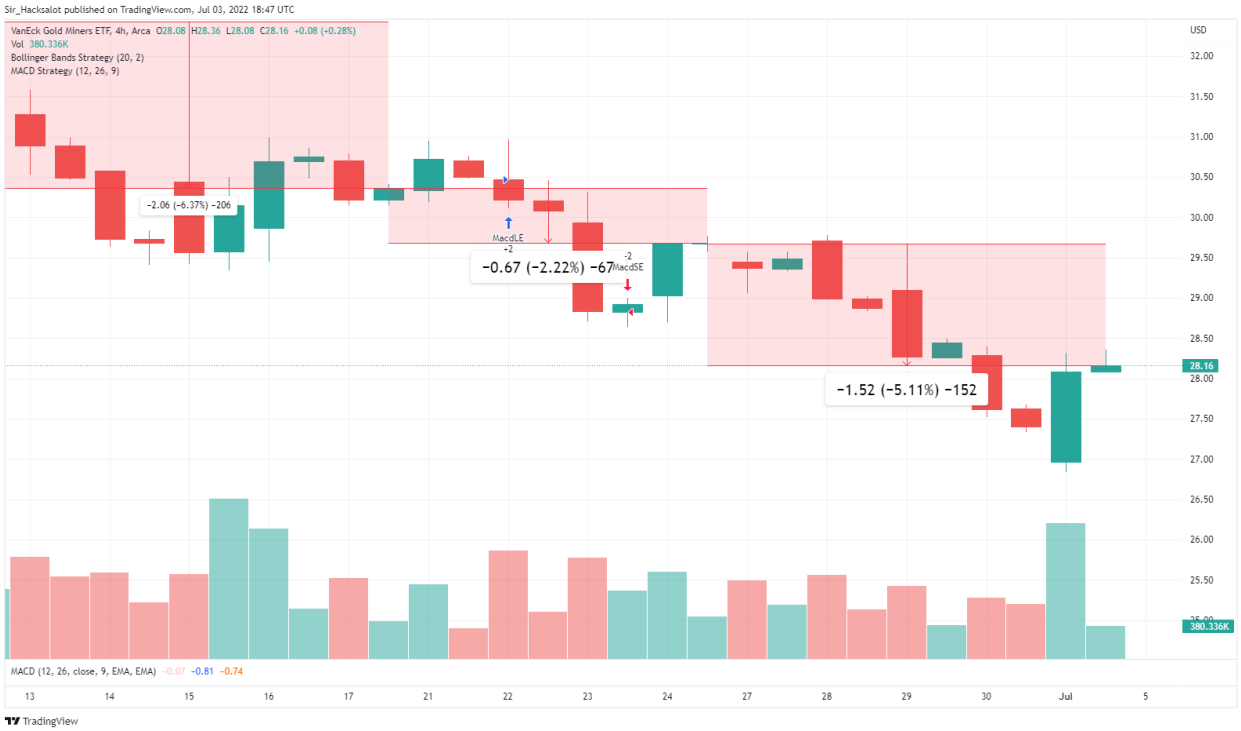

Figure 3.19: GDX Over Week 4

Table 3.5 gives a list of all positions at the end of Week 4 before they were closed. All three assets dropped in value over week 4.

Table 3.5: Final position summary at the end of Week 4.

Symbol	Qty	Avg Fill Price	Last Price	Profit	Asset Value
DIS	324	$ 107.67	$ 96.14	$ (3,735.72)	$ 31,149.36
GDX	1,080	$ 32.45	$ 28.16	$ (4,633.20)	$ 30,412.80
CWH	1,139	$ 26.30	$ 21.91	$ (5,000.21)	$ 24,955.49
			Total:	$ (13,369.13)	$ 86,517.65

Table 3.6 gives a list of all transactions in Week 4. To close out the positions in the account using the buy and hold strategy, all three assets were sold at the end of the trading day on Friday, July 1st.

Table 3.6: Trading record for Week 4.

Time	Symbol	Buy/ Sell	Qty	Price	Net Cost/ Proceeds	Profit/ Loss	Total Cash
7/1/2022 15:30	CWH	Sell	-1139	$ 21.91	$ 24,955.49	$ (5,000.21)	$ 25,068.71
7/1/2022 15:30	GDX	Sell	-1080	$ 28.16	$ 30,412.80	$ (4,633.20)	$ 55,481.51
7/1/2022 15:30	DIS	Sell	-324	$ 96.14	$ 31,149.36	$ (3,735.72)	$ 86,630.87

Chapter 4: Technical Analysis Day Trading

4.1 Assets Selected

The assets selected for this strategy were the same as those selected for the Buy and Hold strategy: Camping World Holdings, Inc. (CWH), Walt Disney Company (DIS), and VanEck Gold Miners ETF (GDX). This decision was made to ensure any differences in results were due to the strategies themselves, not the performance of the assets selected.

4.2 Simulation

4.2.1 Week 1 (06/06-06/11)

As covered in *Chapter 3.1.1*, the market started Week 1 of the experiment in an upward trend, which quickly dissipated as the market reverted to its overall bearish trend that had dominated the previous several weeks. CWH was up at the beginning of the week, which resulted in the MACD line crossing above the signal line on Tuesday, June 7th as seen in Figure 4.1. This triggered a long entry into CWH.

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Figure 4.1: CWH Chart Week 1

Later in the week, the markets resumed their downward trend. Looking at the chart in Figure 4.2 the MACD line crossed below the signal line for DIS on June 8th. The Price also fell from the upper Bollinger band and crossed the SMA. These factors triggered a short entry into DIS.

Figure 4.2: DIS Chart Week 1

Finally, as seen in Figure 4.3, the MACD line crossed below the signal line for GDX on June 9th, triggering a long entry into GDX. On June 10th, the price rebounded from the lower Bollinger band and crossed the SMA line. This triggered a reversal of the current short position. So, the short position closed at a slight loss and reversed into a long position.

Figure 4.3: GDX Chart Week 1

Table 4.1 gives a list of all transactions in Week 1.

Table 4.1: Trading record for Week 1.

Time	Symbol	Buy/Sell	Qty	Price	Net Cost/Proceeds	Profit/Loss	Total Profit	Total Cash
6/6/2022 12:30								$ 100,000.00
6/7/2022 12:31	CWH	Buy	1,100	$ 26.94	$ 29,634.00			$ 70,216.00
6/8/2022 12:32	DIS	Sell Short	-308	$ 107.19	$ 33,014.52			$ 103,230.52
6/9/2022 12:32	GDX	Sell Short	-1,048	$ 31.47	$ 32,980.56			$ 136,211.08
6/10/2022 12:32	GDX	Buy to Cover	1,048	$ 32.43	$ 33,986.64	$ (1,006.08)	$ (1,006.08)	$ 102,224.44
6/10/2022 12:32	GDX	Buy	1,048	$ 32.43	$ 33,986.64			$ 68,237.80

Table 4.2: Open positions at the end of Week 1.

Symbol	Qty	Avg Fill Price	Last Price	Profit
DIS	-308	$ 107.19	$ 99.40	$ 2,399.32
GDX	1,048	$ 32.43	$ 32.47	$ 41.92
CWH	1,100	$ 26.94	$ 26.70	$ (264.00)

4.2.2 Week 2 (06/13-06/18)

Week 2 was a volatile week for the stock market. As covered in *Chapter 3.1.2*, the market fell sharply at the beginning of the week and then experienced a short-term rebound after the Federal Reserve announced its rate hike. The market finished the week down approximately 4.75%. This volatility presented a great opportunity to profit from swing trading using the technical analysis strategy.

CWH fell approximately 5% between Monday, June 13th, and Tuesday, June 14th. As seen in Figure 4.4, this caused the MACD line to cross below the signal line, which triggered a reversal of the current long position into a short position. The long position was closed at a 5.73% loss. The stock continued to fall throughout the week and closed with the new short position up over 10%.

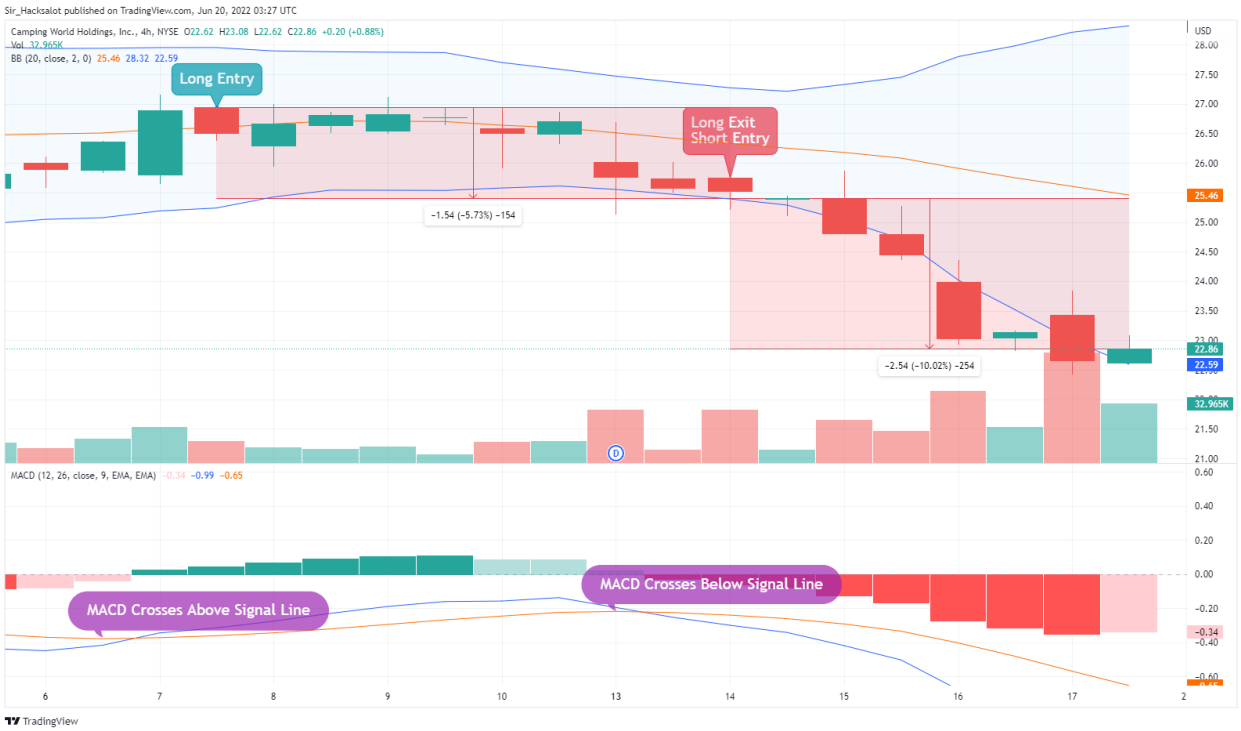

Figure 4.4: CWH Chart Week 2

DIS also fell sharply throughout the week. In Figure 4.5, the price did cross below the lower Bollinger band on Tuesday; however, no action was taken. The MACD line was still below the signal line, and there was still opportunity for the stock to fall lower. The current short position was up almost 12% at the end of the week.

Figure 4.5: DIS Chart Week 2

GDX fell at the beginning of the week, but then rebounded slightly after the Wednesday Fed decision. No action was taken on GDX that week. As seen in Figure 4.6, GDX closed out the week with a 6.37% loss on the current long position.

Figure 4.6: GDX Chart Week 2

Table 4.3 gives a list of all transactions in Week 2. The only trade that was made was a reversal of the CWH position on Tuesday. This long position was closed at a small loss and an entry into a short position was executed.

Table 4.3: Trading record for Week 2.

Time	Symbol	Side	Qty	Price	Net Cost/Proceeds	Profit/Loss	Total Profit	Total Cash
6/14/2022 10:00	CWH	Sell Short	1,100	$ 25.40	$ 27,940.00	$ (1,694.00)	$ (2,700.08)	$ 96,177.80
6/14/2022 10:04	CWH	Sell Short	-1,180	$ 25.37	$ 29,936.60			$126,114.40

Table 4.4 gives a list of all open positions at the end of Week 2. The DIS and CWH short positions are both up slightly. The GDX long position is down slightly.

Table 4.4: Open positions at the end of Week 2.

Symbol	Qty	Avg Fill Price	Last Price	Profit
DIS	-308	$ 107.19	$ 94.34	$ 3,957.80
GDX	1,048	$ 32.43	$ 30.39	$ (2,137.92)
CWH	-1,180	$ 25.37	$ 22.81	$ 3,020.80

4.2.3 Week 3 (06/20-06/25)

As discussed in 3.1.3, Week 3 saw markets make a short-term rally. This market rally saw GDX and DIS make strong gains throughout the week. This caused a reversal of the short positions in those assets. GDX trended lower throughout the week, which prompted a reversal of the long position in GDX.

CWH gained approximately 3.5% throughout the week. On Friday, June 26th the MACD line crossed above the signal line as seen in Figure 4.7. This prompted a reversal of the current short position. The CWH short position was closed at a profit and a long position was taken.

Figure 4.7: CWH Chart Week 3

DIS also gained approximately 3.5% over Week 3. On Thursday, June 24th, The MACD line crossed above the signal line as seen in Figure 4.8. This prompted an exit from the current short position. On Wednesday, June 23rd, the DIS short position was closed at a profit. The decision was made to wait and see if the upward trend would continue before entering a long position. On Friday, June 24th, the trend did continue, so DIS was bought and a long position was taken.

Figure 4.8: DIS Chart Week 3

GDX continued to fall throughout the week. On Wednesday, June 22nd, the MACD line crossed below the signal line, as seen in Figure 4.9. This prompted the reversal of the current long position. On Thursday, June 23rd, the current long position was closed at a slight loss and a short position was entered. Unfortunately, GDX experienced an approximate 4% gain on Friday, and the short position was currently down.

Figure 4.9: GDX Chart Week 3

Table 4.4 gives a list of all transactions in Week 3. Closing the DIS short realized a large profit and brought the total account profit back into the positive. Closing the GDX long realized a large loss and pulled the account's total profit back into the negative. Finally, closing the CWH short also realized some profits. Total profits were $-897.64 at the end of Week 3.

Table 4.5: Trading record for Week 3.

Time	Symbol	Buy/Sell	Qty	Price	Net Cost/Proceeds	Profit/Loss	Total Profit	Total Cash
6/22/2022 12:30	DIS	Buy to Cover	308	$ 94.48	$ 29,099.84	$ 3,914.68	$ 1,214.60	$ 97,014.56
6/23/2022 12:30	GDX	Sell	1,048	$ 28.84	$ 30,224.32	$ (3,762.32)	$ (2,547.72)	$ 127,238.88
6/23/2022 12:32	GDX	Sell Short	-1,120	$ 28.82	$ 32,278.40			$ 159,487.28
6/24/2022 8:33	DIS	Buy	336	$ 96.07	$ 32,279.52			$ 127,207.76
6/24/2022 12:36	CWH	Buy to Cover	1,180	$ 23.71	$ 27977.80	$ 1,958.80	$ (588.92)	$ 99,229.96
6/24/2022 12:36	CWH	Buy	1,180	$ 23.71	$ 27,977.80			$ 71,252.16

Table 4.5 gives a list of all open positions at the end of Week 3. The GDX and CWH positions were both down slightly. The DIS position was up slightly.

Table 4.6: Open positions at the end of Week 3.

Symbol	Qty	Avg Fill Price	Last Price	Profit
GDX	-1,120	$ 28.82	29.66	$ (940.80)
DIS	336	$ 96.07	97.78	$ 574.56
CWH	1,180	$ 23.71	23.47	$ (283.20)

4.2.4 Week 4 (06/27-07/02)

As discussed in 3.1.4, markets continued downward in Week 4 after the short-term rally in Week 3. All three assets declined in value over Week 4. This caused a reversal of the short positions in those assets. GDX trended lower throughout the week, which prompted a reversal of the long position in GDX.

CWH lost approximately 7.3% throughout the week. On Tuesday, June 28th the MACD line crossed below the signal line as seen in Figure 4.10. This prompted a reversal of the current long position. The CWH long position was closed at a loss and a short position was taken. On Friday, July 1st, the short position was closed at a loss to complete the experiment.

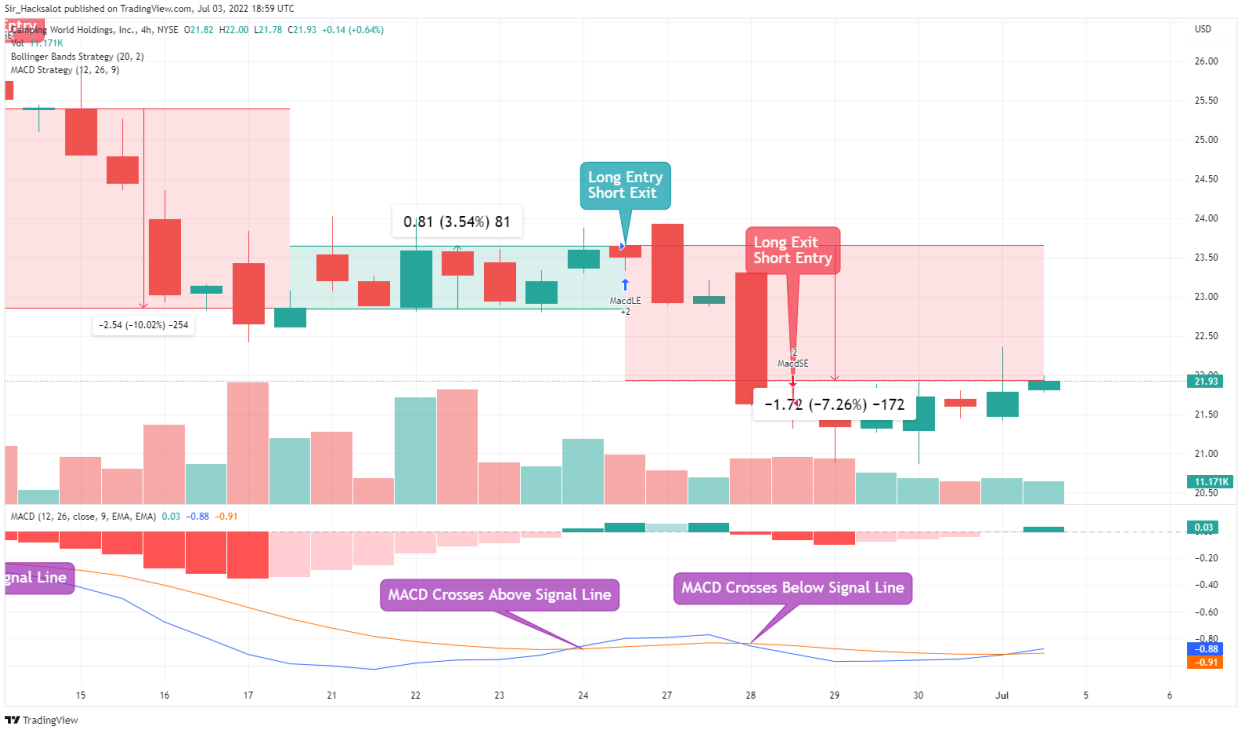

Figure 4.10: CWH Over Week 4

DIS also lost approximately 1.6% over Week 4. The MACD line stayed above the signal line throughout the week as seen in Figure 4.11. No action was taken until Friday, July 1st when the stock was sold at a small profit to complete the experiment.

Figure 4.11: DIS Over Week 4

GDX trended lower over the week but experienced a rally on Friday. The MACD line stayed below the signal line throughout the week as seen in Figure 4.12. No action was taken until Friday, July 1st when the short position was closed at a profit to complete the experiment.

Figure 4.12: GDX Over Week 4

Table 4.7 gives a list of all transactions in Week 4. The CWH long position was closed on Tuesday, June 28th at a loss of $-2,548.80. On Friday, July 1st, all open positions were closed to complete the experiment. The total profit at the end of Week 4 was $-2,799.80.

Table 4.7: Trading record for Week 4.

Time	Symbol	Side	Qty	Price	Net Cost/Proceeds	Profit/Loss	Total Profit	Total Cash
6/28/2022 12:58	CWH	Sell	1,180	$ 21.55	$ 25,429.00	$ (2,548.80)	$ (3,137.72)	$ 96,681.16
6/28/2022 12:58	CWH	Sell Short	-1,180	$ 21.55	$ 25,429.00			$ 122,110.16
7/1/2022 15:30	CWH	Buy to Cover	1,180	$ 21.91	$ 25,853.80	$ (424.80)	$ (3,562.52)	$ 96,256.36
7/1/2022 15:30	DIS	Sell	336	$ 96.14	$ 32,303.04	$ 23.52	$ (3,539.00)	$ 128,559.40
7/1/2022 15:30	GDX	Buy to Cover	1,120	$ 28.16	$ 31,359.20	$ 739.20	$ (2,799.80)	$ 97,200.20

Chapter 5: Analysis and Results

5.1 Analysis of Overall Strategy Performance

5.1.1 Buy and Hold

The value of the account following the buy and hold strategy started at $100,000 and ended at $86,630.87. The account lost 13.37% over the four-week experiment. All three held stocks lost value over the duration of the experiment.

Figure 5.1 shows the performance of CWH throughout the experiment. The asset trended lower throughout the experiment, with small rallies in Week 3 and at the end of Week 4. The asset lost 18.52% over the period it was held for.

Figure 5.2 shows the performance of DIS throughout the experiment. This asset also trended lower throughout the four weeks it was held and experienced similar rallies in weeks 3 and 4. DIS lost 9.93% over the period it was held.

Figure 5.3 shows the performance of GDX throughout the experiment. The fund also followed a downward trend over the four weeks. It experienced a rally at the end of Week 1 and the end of Week 4. GDX lost 12.67% over the period it was held.

Figure 5.1: CWH B&H Performance

Figure 5.2: DIS B&H Performance

Figure 5.3: GDX B&H Performance

5.1.2 Technical Analysis Day Trading

The value of the account following a technical analysis-based day trading strategy started at $100,000 and ended at $97,200.22. The account lost 2.8% over the four-week experiment. All three traded stocks lost value over the duration of the experiment.

Figure 5.4 shows the performance of CWH throughout the experiment as well as the trades made on the asset. The account lost on the first long position on this stock but made a large profit in the following short position in Week 2. At the beginning of Week 3, a long position was taken and then later reversed into a short, at a loss. The final short position was closed at a loss.

Figure 5.5 shows the performance of DIS throughout the experiment as well as the trades made on the asset. The first short position on this stock performed very well as the stock trended lower. In Week 2, the long position was reversed into a short position. This short position was

reversed into a long position at a profit at the end of Week 3. In Week 4, the long position was reversed again into another short position at a loss. This short was closed halfway through Week 3 at an approximate 12% profit. At the end of Week 3, a long position was taken. This long position was closed at an approximate 1.6% loss at the end of the experiment.

Figure 5.6 shows the performance of GDX throughout the experiment as well as the trades made on the fund. The first short position was reversed into a long at a 3.5% loss at the end of Week 1 after the fund experienced a rally. This long position performed poorly as the fund lost value over the next weeks. At the end of Week 3, the long position was reversed into a short position at a 10% loss. The short position was closed at a 2.34% profit at the end of the week.

Figure 5.4: CWH TA Performance

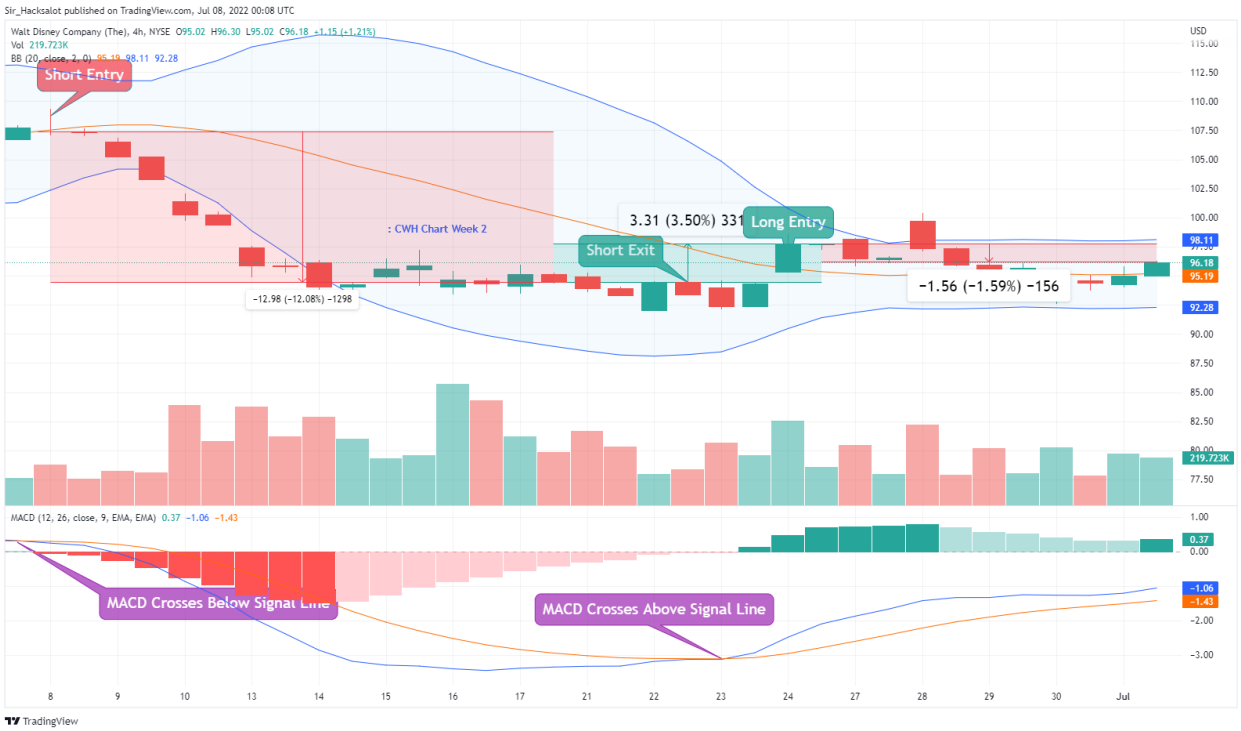

Figure 5.5: DIS TA Performance

Figure 5.6: GDX TA Performance

5.1.3 Market Performance

By analyzing the performance of the stock market over the four-week experiment, a baseline can be established to compare against the two strategies. As seen in Figure 5.7, the NASDAQ 100 Index trended lower in Week 1 and Week 2. Week 3 was characterized by a large recovery while markets trended lower once again in Week 4. The NASDAQ 100 Index lost about 9.1% by the end of the experiment. If $100,000 were invested into a portfolio mimicking the NASDAQ 100, the final value would be approximately $91,152 at the end of the experiment.

As seen in figure 5.8, the S&P 500 had a very similar performance to the NASDAQ 100 throughout the four-week trading period. The index trended lower in weeks 1 and 2, followed by a recovery in Week 3. In Week 4, the S&P resumed its bearish trend and finished out the week down about 7.9% from the beginning of the experiment. If $100,000 were invested into a portfolio mimicking the NASDAQ 100, the final value would be approximately $92,748 at the end of the experiment.

Figure 5.7: NASDAQ 100 Index Performance

Figure 5.8: S&P 500 Performance

5.2 Comparative Analysis

Looking at the strategies in comparison to one another gives valuable insight into the performance of the strategies. Comparing them against market performance also provides useful information. Figure 5.9 depicts a graph of the total account value of the TA strategy and Buy and Hold strategy by day. The S&P 500 Index and NASDAQ 100 Index were also graphed. To get data for the indexes, backtests were simulated in which $100,000 of each index value was purchased at the beginning of the experiment. In reality, indexes such as the S&P 500 cannot be traded and merely serve as indicators, however, simulating the purchase of the indexes with $100,000 in initial value scales the indexes such that they start at the same value as the two strategies used in the experiment.

As seen in Figure 5.9, both strategies initially outperformed the market indexes in Week 1 and Week 2. In Week 3 and Week 4 the Buy and Hold strategy underperformed the market. The TA Strategy outperformed the market throughout the experiment. The Buy and Hold strategy also had the largest maximum drawback at $15,129, whereas the maximum drawback of the TA strategy was only $3316.

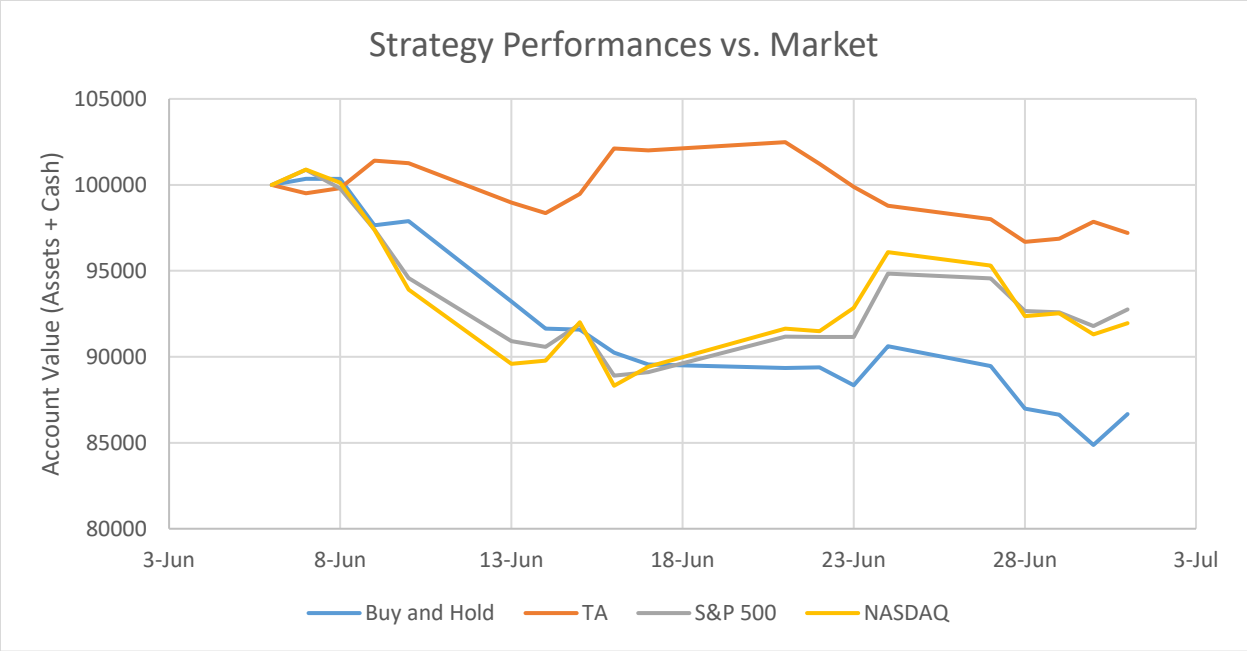

Figure 5.9: Account Value by Day for Each Strategy

Chapter 6: Conclusion

The primary goal of this research was to develop an understanding of the stock market while conducting an experiment to determine the differences and viabilities of investment strategies. This goal was achieved in that a broad overview of the stock market was researched, and insight was gained into the history of the stock market, market influences, indexes and market indicators, and fundamental and technical analysis of individual stocks, and the market as a whole. This knowledge was used to choose two investing strategies, select three securities to trade using these strategies, and then perform a meaningful evaluation of the results of the experiment.

Although both trading strategies ended the experiment at a loss, there was still valuable information to be learned from the experiment and distinctions to be made between the strategies. The technical analysis strategy outperformed both the buy and hold strategy and the general market by a substantial margin. This was notable, as it is a common belief that buying and holding, or other passive strategies, are generally safer and more reliable in the long term. As the research reveals, using a more active approach was much more successful in this case. This indicates that an active strategy may be more favorable than a passive strategy in bearish market conditions such as those encountered throughout the experiment period.

Historical research reveals that buying and holding generally does perform well in the long term. If this trading simulation were run over a much longer timeframe, the buy and hold method would likely outperform the more active strategy. Thus, if an asset has good fundamental value, it is often more advantageous to hold the asset, as it is exceedingly hard to predict market movements in the short term, while in the long term, the U.S. stock market trajectory is always upward.

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