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Bitcoin Investment on a Stock Exchange

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Objectives of thesis

Utilizing technical analysis, the aim of this diploma thesis is to determine whether or not certain trading strategies for MicroStrategy company shares are profitable. Trading strategies must be devised in order to accomplish this purpose. The methodology, the literature review, and the practical part form the three primary components of the thesis. Indicators, formulas, evaluation statistics, and methodologies that are necessary for the creation and evaluation of trading strategies are represented in the methodological portion of the document. A summary of the necessary theoretical knowledge on the stock market, chart and trend analysis, and trading techniques is provided in the literature study. The application section of the dissertation focuses on the development of trading strategies, specifically those that make use of the Relative Strength Index (RSI) in conjunction with Bollinger Bands and the Volume indicator. The findings that were obtained are evaluated and improved upon in accordance with the analysis of the observations in order to make the most profit possible. Comparisons are made for the benefit of investors between the outcomes achieved by each trading strategy.

Methodology

In the process of developing trading strategies, quantitative approaches were applied. These techniques were based on primary data already available from Trading view, where the data was also analyzed. Candlesticks of daily data were utilized for the analysis. The span of time in question extends from January 1, 2012, through December 31, 2021. Bollinger Bands, Volume, and RSI are the three indicators employed in technical analysis, and their combinations are based on mathematical formulas. The author made adjustments to any and all data or settings that remained.

For the purpose of practical evaluation, the following methods were utilized: gross profit or loss, the total quantity of trades, average profit or loss trade, net profit, profit factor, and share between profitable and unprofitable trades.

The indicators of technical analysis were optimized to ensure that the trading strategy could maximize profits. As a result, the values of the parameters that were determined to be optimal were those that achieved the highest evaluation possible. We compared the parameters that had been optimally established and changed with the parameters that were provided.

The proposed extent of the thesis

60 pages

Keywords

Bitcoin, investment, stock exchange, cryptocurrency, technical analysis, MicroStrategy, trading

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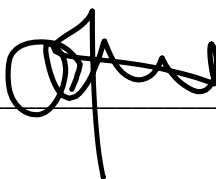
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Declaration

I declare that I have worked on my master's thesis titled "Bitcoin investment on a stock exchange" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 30.3.2023 _____

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Bitcoin Investment on a Stock Exchange

Abstract

Employing technical analysis, the purpose of this master's thesis is to determine whether or not certain trading strategies for MicroStrategy company shares are profitable for investors. Trading strategies must be devised to accomplish this objective. The methodology, the literature review, and the practical part comprise the three primary components of the dissertation. Indicators, equations, evaluation statistics, and methodologies that are necessary for the creation and evaluation of trading strategies are represented in the methodological part of the document. A summary of the necessary theoretical aspects of the stock market, chart and trend analysis, and trading techniques is provided in the literature study. The application section of the dissertation focuses on the development of trading strategies, specifically those that make use of the Relative Strength Index (RSI) in conjunction with Bollinger Bands and the Volume indicator. The findings that were obtained are evaluated and improved upon following the analysis of the observations to make the most profit possible. Comparisons are made for the benefit of investors between the outcomes achieved by each trading strategy.

Keywords: Technical analysis, stock, technical indicators, chart patterns, trading systems, optimization, MicroStrategy, Dow theory, trend.

Bitcoin investice na burze

Abstrakt

Pomocí technické analýzy je cílem této diplomové práce zjistit, zda jsou určité obchodní strategie pro akcie společnosti MicroStrategy pro investory výhodné. K dosažení tohoto cíle musí být navrženy obchodní strategie. Metodika, přehled literatury a praktická část tvoří tři hlavní složky disertační práce. V metodické části dokumentu jsou uvedeny ukazatele, rovnice, statistiky hodnocení a metodiky, které jsou nezbytné pro tvorbu a hodnocení obchodních strategií. Shrnutí nezbytných teoretických aspektů na akciovém trhu, analýza grafů a trendů a obchodní techniky jsou uvedeny ve studii literatury. Aplikační část disertační práce se zaměřuje na vývoj obchodních strategií, konkrétně těch, které využívají index relativní síly (RSI) ve spojení s Bollinger Bands a indikátorem hlasitosti. Získané poznatky jsou vyhodnocovány a vylepšovány v souladu s analýzou pozorování, aby bylo dosaženo co největšího zisku. Srovnání se provádí ve prospěch investorů mezi výsledky dosaženými každou obchodní strategií.

Klíčová slova: Technická analýza, akcie, technické ukazatele, vzory grafů, obchodní systémy, optimalizace, Mikrostrategie, Dow teorie, trend.obchodní strategie.

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1 Introduction

The financial market plays a crucial role in the development and growth of an economy. It provides a means for individuals and businesses to access the funds they need to invest in their operations and grow. The financial market includes a range of institutions and vehicles, such as banks, insurance companies, and stock exchanges, that facilitate the flow of capital between savers and borrowers. These institutions provide the necessary infrastructure for individuals and businesses to invest, borrow, and save money, and they play a key role in channeling capital to its most productive uses. By doing so, the financial market helps to support economic growth, create jobs, and improve living standards.

There is interest in price forecasting in the financial market because it can provide valuable information to investors and traders. Price forecasting involves using various techniques and tools to predict future price movements in the market. This information can be useful for investors and traders because it can help them make more informed and strategic decisions about their investments. For example, if a price forecast indicates that the price of a particular asset is likely to increase in the future, an investor may decide to buy the asset to take advantage of the potential price appreciation

Price forecasting can also be useful for businesses and other organizations that are looking to make strategic decisions about their operations. For example, a company may use price forecasts to help determine the best time to buy raw materials or sell finished goods, to maximize profits and minimize losses. Overall, there is interest in price forecasting in the financial market because it can provide valuable information and insights that can help investors and traders make more informed and strategic decisions about their investments.

Technical analysis and fundamental analysis are the two primary types of analysis that are utilized in the field of investing. Both of these types of analysis can be employed to anticipate how business shares will behave shortly and to develop a trading strategy for one's use.

This master thesis will center on the technical analysis of MicroStrategy stock which is one of the largest publicly traded holders of Bitcoin on their balance sheet

2 Objectives and Methodology

2.1 Objectives

Utilizing technical analysis, this diploma thesis aims to determine whether or not certain trading strategies for MicroStrategy company shares are profitable. Trading strategies must be devised to accomplish this purpose. The methodology, the literature review, and the practical part form the three primary components of the thesis. Indicators, formulas, evaluation statistics, and methodologies that are necessary for the creation and evaluation of trading strategies are represented in the methodological portion of the document. A summary of the necessary theoretical knowledge on the stock market, chart and trend analysis, and trading techniques are provided in the literature study. The application section of the dissertation focuses on the development of trading strategies, specifically those that make use of the Relative Strength Index (RSI) in conjunction with Bollinger Bands and the Volume indicator. The findings that were obtained are evaluated and improved upon under the analysis of the observations to make the most profit possible. Comparisons are made for the benefit of investors between the outcomes achieved by each trading strategy.

2.2 Methodology

In the process of developing trading strategies, quantitative approaches were applied. These techniques were based on primary data already available from the Trading view, where the data was also analyzed. Candlesticks of daily data were utilized for the analysis. The period in question extends from January 1, 2012, through December 31, 2021. Bollinger Bands, Volume, and RSI are the three indicators employed in technical analysis, and their combinations are based on mathematical formulas. The author made adjustments to any data or settings that remained.

For practical evaluation, the following methods were utilized: gross profit or loss, the total quantity of trades, average profit or loss trade, net profit, profit factor, and share between profitable and unprofitable trades. The indicators of technical analysis were optimized to ensure that the trading strategy could maximize profits. As a result, the values of the parameters that were determined to be optimal were those that achieved the highest evaluation possible. We compared the parameters that had been optimally established and changed with the parameters that were provided.

2.2.1 Bollinger bands

Bollinger bands are a technical analysis tool that consists of a set of three curves drawn concerning securities prices. The middle band represents a moving average of prices, typically the 20-day simple moving average, which is surrounded by an upper band and a lower band. These bands are typically set two standard deviations above and below the middle band (Lento & Gradojevic, 2007).

The purpose of Bollinger bands is to provide a relative definition of high and low prices of security. By definition, prices are high in the upper band and low in the lower band. A security's volatility is also determined by the distance between the bands, as the wider the bands, the more volatile the security.

Bollinger bands can be used in a variety of ways, including identifying overbought and oversold conditions, anticipating price breakouts, and finding trends. Many traders use Bollinger bands in conjunction with other technical indicators to confirm the signals generated by the bands. For example, if the price breaks above the upper band, it may be a signal to buy, while if it breaks below the lower band, it may be a signal to sell. However, it is important to note that Bollinger Bands should not be used in isolation and should be combined with other technical and fundamental analysis techniques.

Bollinger Bands are used to identify potential changes in a security's volatility. When the price of a security is moving within the bands, it is generally considered to be trading within a normal range (Pang, 2006). However, if the price moves outside of the bands, it may indicate that the security is becoming more volatile and that a trend change is imminent.

Traders often use Bollinger Bands in conjunction with other technical indicators to generate buy and sell signals.

A moving average is a technical analysis tool that is used to smooth out price data by creating a constantly updated average price (Hansun, 2013). There are several different types of moving averages, each of which is calculated differently, but the most commonly used moving average is the simple moving average (SMA), calculated as follows:

Equation (1)

$$SMA = \frac{A1 + A2 + \cdots + An}{n} \tag{1}$$

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where:

- SMA is the simple moving average
- Price 1, price 2, ..., price N are the prices of the security for the N periods being considered
- N is the number of periods being considered
- For example, if a trader wants to calculate the 10-day simple moving average of a security's price, they would add up the prices of the security for the previous 10 days and divide the result by 10.

Standard deviation is a statistical measure of the dispersion of a set of data from its mean. The formula for calculating standard deviation is as follows:

Equation (2)

$$S_x = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n - 1}} \tag{2}$$

where:

- Standard deviation is the measure of dispersion
- x_1, x_2, ..., x_n are the individual data points in the set
- Mean is the average of the data points
- N is the number of data points in the set

To comprehend the distribution and properties of a data set, the standard deviation is frequently used in conjunction with other statistical measures, such as mean and variance. It is frequently used in technical analysis to calculate Bollinger Bands and other measures of volatility.

To calculate the upper and lower bands of Bollinger Bands, you will need to follow these formulas:

Upper band = SMA + (standard deviation x number of standard deviations)

Lower band = SMA - (standard deviation x number of standard deviations)

For example, if the SMA of a security's price is $100 and the standard deviation is $10,

the upper band would be calculated as $100 + (10 x 2) = $120, and the lower band would be calculated as $100 - (10 x 2) = $80.

The upper and lower bands are used to identify potential changes in the security's volatility. When the price of the security is trading within the bands, it is generally considered to be trading within a normal range. However, if the price moves outside of the bands, it may indicate that the security is becoming more volatile and that a trend change is imminent.

Trading Strategy based on Bollinger bands

Several trading strategies can be based on Bollinger Bands. Here are a few examples:

Trend-following strategy: When the price of a security breaks above the upper Bollinger Band, it may be a sign that the security is in an uptrend. Conversely, when the price breaks below the lower Bollinger Band, it may be a sign that the security is in a downtrend. Traders can use this information to enter a long position when the price breaks above the upper band and a short position when the price breaks below the lower band.

Range-bound strategy: When the price of a security is trading within the Bollinger Bands, it may be in a range-bound market. In this case, traders can look for opportunities to buy at the lower band and sell at the upper band.

Reversal strategy: When the price of a security moves outside of the Bollinger Bands, it may be a sign that a trend reversal is imminent. Traders can look for bullish reversal patterns, such as a double bottom or a bullish divergence, when the price is near the lower band, or bearish reversal patterns, such as a double top or a bearish divergence when the price is near the upper band.

2.2.2 Volume indicator

The volume indicator is a technical analysis tool that is used to measure the level of activity in a security or market. It is typically plotted as a histogram or bar chart on a price chart, and it shows the number of shares or contracts that have been traded over a given period (Taş & Akdağ, 2012).

Volume is an important consideration for traders because it can provide insight into the strength or weakness of a price move (Stickel & Verrecchia, 1994). For example, if the price of a security is increasing but the volume is decreasing, it may indicate that the move is not as strong as it appears and that the trend could be in danger of reversing. On the other hand, if the price is increasing and the volume is also increasing, it may indicate that the move is strong and that the trend is likely to continue (Anderson & Dyl, 2005).

Traders often use the volume indicator in conjunction with other technical analysis tools, such as moving averages and trend lines, to confirm price trends and generate buy and sell signals. However, it is important to note that volume is just one factor to consider when analyzing a security's price action, and it should be used in combination with other technical and fundamental analysis techniques to get a complete and accurate picture of the security's trend and volatility.

There are several different types of volume indicators that traders can use, including:

1. **Raw volume**: Raw volume is the actual number of shares or contracts that are traded during a certain period. It is an essential piece of data for traders and investors who want to make educated choices about their investments to maximize their returns. Raw volume may be expressed as the number of shares or contracts that are exchanged.

The raw volume is an important parameter for several different reasons. To begin, it gives a picture of the degree of activity that was there in the market at a certain point in time. Raw volume may be an indicator of the amount of interest and activity in a specific stock or market; conversely, the low raw volume may suggest that there is a lack of trading activity or interest in the stock or market.

Second, the sheer volume of transactions might provide insightful information on the movements and patterns of the market. Traders and investors may discover patterns and trends in the market and make educated judgments about whether to purchase or sell their assets if they monitor the raw volume over some time and follow this volume over time.

Third, raw volume may be used in combination with other measures to create a more comprehensive picture of market activity. This can be done by combining the two measurements. For instance, to get a more in-depth comprehension of the tendencies and movements of the market, traders and investors may also look at price changes, market breadth, and other indicators.

Tracking and analyzing raw volume may be accomplished in different ways. Utilizing charts and graphs to provide a visual representation of trade activity over some time is a frequent approach. Traders and investors may benefit from using these charts to spot patterns and trends in trading activity, which can then assist them in making more educated choices about their investments.

2. **On-balance volume (OBV):** This indicator plots the net total of volume that is flowing into or out of a security, with positive volume indicating buying pressure and negative volume indicating selling pressure.

This indicator depicts the net sum of volume that is flowing into or out of a security, with positive volume suggesting purchasing pressure and negative volume indicating selling pressure. Positive volume indicates that there is more demand for the asset, while negative volume indicates that there is more demand for selling it.

Traders and investors use the OBV indicator so that they may recognize patterns and trends in the activity of the market and make educated judgments on the times at which they should purchase or sell their assets. Traders and investors may obtain a better knowledge of the market mood and make more educated judgments about their investments by analyzing the volume of purchasing and selling pressure for a specific asset over time.

The use of the OBV indicator offers several advantages, one of the most important of which is the provision of a more complete picture of market activity than is offered by price fluctuations alone. Price changes may not always accurately represent the underlying attitude and activity of the market, even though price movements can give useful insights into the patterns and movements of the market. Traders and investors can obtain a more in-depth grasp of the underlying market dynamics and make judgments on their investments that are more informed when they use the OBV indicator.

The OBV indicator is also helpful for determining whether or not there will be a change in the direction in which a market trend is moving in. If the OBV indicator starts moving in the opposite direction of price action, this may be an indication that the market is

getting close to a turning point and that there will soon be a change in the general direction that it has been moving in. Traders and investors can anticipate probable trend reversals and make better-educated choices about whether to purchase or sell their assets when they use the OBV indicator in combination with other technical analysis tools.

Many different things may have an effect on the OBV indication for a particular security. The dissemination of news and events that affect the underlying firm or industry is one of the most critical variables. For instance, if a business reports great profits or makes an announcement about a new product, this may lead to an increase in purchasing pressure and a positive OBV for the security in question. Similar to how positive news or events may lead to greater buying pressure and a positive OBV, bad news or events can contribute to a negative OBV.

3. **Volume-weighted average price (VWAP):** This indicator calculates the average price of a security based on the volume of trades. The VWAP indicator gives a more accurate picture of market activity than other technical analysis indicators, which is one of the primary advantages of employing this indicator. Indicators like the simple moving average (SMA) and the exponential moving average (EMA), for instance, give helpful insights into the patterns and movements of the market; nevertheless, they do not take into consideration the volume of transactions. The volume-weighted average price (VWAP) indicator, on the other hand, gives a more complete perspective of market activity since it takes into account the number of deals.

One further advantage of using the VWAP indicator is the fact that it helps determine probable support and resistance levels for security. Support and resistance levels are regions in the price chart of a security where it is anticipated that there will be a brief or protracted stop in the movement of the price. Traders and investors may discover possible support and resistance levels for security by calculating the volume-weighted average price (VWAP), which enables them to make better-educated choices about whether to purchase or sell their assets.

The VWAP indicator for particular securities may be influenced in many ways by a variety of variables. One of the most important considerations is the recent news and events that affect the underlying firm or industry. For instance, if a firm reports great profits or launches a new product, this may contribute to a rise in purchasing pressure

and a positive VWAP for that security. Similarly, if a company receives favorable news coverage, this may lead to a positive VWAP. In a similar vein, unfavorable news or occurrences might contribute to an increase in the amount of selling pressure and a negative VWAP.

2.2.3 Relative Strength Index

The Relative Strength Index (RSI) is a technical analysis indicator that measures the strength of a security's price action. It is a momentum oscillator that compares the magnitude of a security's recent gains to the magnitude of its recent losses, to identify overbought or oversold conditions in the market.

The RSI is calculated using the following formula:

$$\mathbf{RSI} = 100 - \left(\frac{100}{1 - \frac{\text{average gain}}{\text{average loss}}} \right) \tag{3}$$

where:

- RSI is the Relative Strength Index
- Average gain is the average of the security's gains over a certain number of periods
- Average loss is the average of the security's losses over the same number of periods
- The RSI is typically plotted on a scale of 0 to 100, with values above 70 generally indicating an overbought condition and values below 30 indicating an oversold condition (Badruzaman, 2019). Traders may use these levels as a guide for generating buy and sell signals, with the expectation that the price will revert toward its mean after reaching overbought or oversold levels.

2.2.4 Stop loss

A stop-loss order is a type of order that is placed with a broker to sell a security when it reaches a certain price. The goal of a stop-loss order is to limit potential losses on trade by automatically selling the security if it falls below a certain price (Lei & Li, 2009).

Stop-loss orders are typically used to protect against extreme price moves in the opposite direction of the trade. For example, if a trader buys a security and wants to limit their potential loss to 10%, they could place a stop-loss order at 10% below the price at which they bought the security.

If the price of the security falls to that level, the stop-loss order will be triggered and the security will be sold, limiting the trader's potential loss to 10%.

It is important to note that stop-loss orders are not guaranteed and may not always be filled at the exact price specified. The actual price at which the order is filled may be higher or lower than the stop-loss price, depending on market conditions. Additionally, stop-loss orders do not guarantee a profit and may result in a loss if the price of the security falls below the stop-loss price before it recovers.

2.2.5   Analyzing trading strategy

- Total quantity of trades: A trade contains the opening and closing of a position.
- Gross profit: Sum of money from all profitable trades
- Gross loss: Sum of money from all unprofitable trades
- Average profit trade: Gross profit divided by the number of all trades.
- Average loss trade: Gross loss divided by the number of all trades.
- Total net profit: The difference between gross profit and gross loss
- Profit factor: The ratio between gross profit and gross loss in %.
- Profitable trades: The number of all profitable trades, a percentage of the total.
- Loss trades: The number of all loss-making trades, a percentage of the total.

3 Literature Review

3.1 Stock market

The stock market is a platform where corporations may sell ownership shares to investors and investors can buy and sell them. Stock markets let companies raise funds for growth and expansion and investors gain a return on their investments.

A share of ownership in a joint-stock company's share capital is represented by a stock, which is a transferable equity security that can be bought and sold (Wagner, 2020). Stockholders are granted the privilege of taking a share in the profits generated by the business in which they have invested their capital. In addition to this, they have the right to receive revenue in the form of dividends and the right to any assets and income that remain after the company has been liquidated. Voting for the election of the firm's governing board is another way for ordinary stockholders to have a say in how the company is managed. There are two main types of markets. Primary market and secondary market.

The primary market is the financial market where new securities are issued to the public and traded for the first time. It is the opposite of the secondary market, where securities that were previously issued and traded on the primary market are bought and sold. In the primary market, companies raise capital by issuing new securities, such as stocks or bonds, and selling them to investors (Albulescu, 2021). The proceeds from the sale of these securities are used to fund the company's operations and expansion.

There are four main types of several types of secondary markets. They are Stock exchanges, over-the-counter markets, bond markets, and derivatives markets.

Stock exchanges are the most well-known type of secondary market, and they are platforms where stocks (securities that represent ownership in a company) are bought and sold. Examples of stock exchanges include the New York Stock Exchange (NYSE) and the NASDAQ.

Over-the-counter markets are markets where securities are traded directly between two parties, without the use of a formal exchange (Benston & Hagerman, 1974). Over-the-counter (OTC) markets are often used for trading securities that are not listed on a formal exchange.

Bond markets are markets where bonds (debt securities issued by companies or governments) are bought and sold (Bessembinder & Maxwell, 2008). Bond markets can be divided into two main categories: primary markets, where new bonds are issued, and secondary markets, where existing bonds are traded.

Derivatives markets are markets where derivatives are bought and sold. Derivatives are financial instruments whose value is derived from the value of an underlying asset, such as a stock or commodity. Examples of derivatives include options and futures contracts (Sobel, 2006).

Overall, the secondary market plays a crucial role in the economy by providing liquidity for securities and allowing investors to sell their investments and access their capital. It also allows for price discovery, as the supply and demand for securities in the secondary market determine their market value.

3.1.1   The Stock Exchanges

The stock market is an intricate and ever-changing mechanism that facilitates the purchasing and selling of shares of publicly listed corporations by investors. There are now several prominent stock exchanges throughout the globe where trading takes place for the shares of the most well-known firms. These stock exchanges are located in a variety of countries. Stock exchanges like this provide a forum for investors to purchase and sell shares, and they play an important part in the functioning of economies all over the world.

The New York Stock Exchange is undoubtedly one of the most well-known and important stock exchanges in the world. (NYSE). Wall Street in New York City is home to the New York Stock Exchange (NYSE), which has a market capitalization of more than $20 trillion. The stock exchange was established in 1792 and has had a lengthy and eventful history since that time. Coca-Cola, Walmart, and ExxonMobil are just a few of the corporations that call the New York Stock Exchange (NYSE) their home today. The NYSE is home to some of the biggest and most well-known companies in the world.

The NASDAQ is a major stock exchange that is also important. The National Association of Securities Dealers (NASDAQ) is an electronic exchange that was

established in 1971 and may be found in New York City. The New York Stock Exchange (NYSE) has a physical trading floor, whereas the NASDAQ does not. Rather than that, every transaction is carried out digitally. A market value of more than $13 trillion is held by the NASDAQ, which is home to a large number of technology businesses such as Amazon, Apple, and Google.

There are other additional stock exchanges located all over the globe in addition to the New York Stock Exchange and the National Association of Securities Dealers. The London Stock Exchange, the Tokyo Stock Exchange, and the Hong Kong Stock Exchange are just a few of the stock exchanges that fall within this category. Every one of these trades has its own set of distinguishing qualities and contributes significantly to the functioning of the global economy.

Because it enables businesses to acquire money and allows investors to make a profit from their holdings, the stock market is an extremely important component of the economy of the whole world. When a firm sells investors a piece of ownership in the business in the form of a share of stock, the company is selling that piece of ownership to the investors. Investors are entitled to a portion of the firm's income in the form of dividends and capital gains in exchange for the money that they put into the company.

The stock market allows businesses to acquire more funding, which they may then use toward their ongoing operations and future expansion. A corporation may obtain money from a large number of investors without taking on any additional debt if it issues shares of stock to those individuals. This is an option that may be appealing to businesses who are wanting to either expand their existing operations or engage in new endeavors.

Investors have the opportunity to increase their returns on their investments by participating in the stock market. Investors may realize capital gains if the price of a company's shares goes up as a result of the company's strong performance and increased profitability. In addition, the shareholders of many firms get dividend payments regularly, which is another source of consistent income.

Investing in the stock market does not come without the possibility of loss. Prices of stocks are notoriously unpredictable and may experience large swings in reaction to a broad range of variables, including the state of the economy, how well companies are doing, and major world events. If an investor is not willing or able to take on this risk, they may be better suited to putting their money in assets that are less volatile, such as savings accounts or bonds.

3.1.1.1 The New York Stock Exchanges

The New York Stock Exchange (NYSE) has a long and rich history. It was founded in 1792 when a group of 24 stockbrokers signed the Buttonwood Agreement on Wall Street in New York City. The agreement established rules for conducting business and set the commission rates that brokers could charge for their services.

Over the next century, the NYSE continued to grow and evolve. In 1817, it moved to a new location on Wall Street, and in 1865, it was incorporated as a non-profit organization. In the late 1800s and early 1900s, the NYSE underwent several major changes, including the adoption of new technologies such as the ticker tape and the telephone. In the decades following World War II, the NYSE continued to thrive.

It became the world's largest stock exchange and a symbol of American capitalism. In the late 1990s and early 2000s, the NYSE underwent a major modernization effort, including the adoption of electronic trading systems (Carlson, 2006).

NYSE shares are "blue chips" and typically belong to rapidly expanding corporations the majority of the time. For a company to be listed on the New York Stock Exchange (NYSE), it must first satisfy the stringent conditions for doing so. The NYSE has maintained its sterling reputation for more than 225 years by providing investors with shares that are consistent and dependable.

The New York Stock Exchange (NYSE) employs a trading system known as a continuous auction, which enables market participants to carry out stock transactions on behalf of investors. They will gather around the appropriate post where a specialist broker, who is employed by an NYSE member firm (that is to say, they are not an employee of the New York Stock Exchange), acts as an auctioneer in an open outcry

auction market environment to bring buyers and sellers together and to manage the actual auction.

3.1.1.2 National Association of Securities Dealers Automated Quotations

The NASDAQ is a stock market index that consists of the largest and most actively traded stocks listed on the NASDAQ stock exchange. It is one of the most widely followed stock market indices in the world and is often used as a barometer of the overall health of the technology sector (Veronesi & Pastor, 2005).

Even though the NASDAQ Stock Market finally took over the majority of the main deals that had previously been carried out through the over-the-counter trading system, there are still numerous securities that are traded using this method. Even as late as 1987, the Nasdaq exchange was frequently referred to as the "OTC" in various materials published in the media.

The New York Stock Exchange is the largest market in the world when measured by market capitalization. The NASDAQ is the second-largest market in the world. On the NASDAQ exchange, more than 3,000 different companies are actively traded.

The National Association of Securities Dealers, Inc. (NASDAQ) is a fully automated exchange, in contrast to the New York Stock Exchange (NYSE). NASDAQ does not have a physical trading floor in the stock market; rather, it is just a network of computers and phones connecting more than five hundred brokerage firms (Carrion, 2012).

3.1.1.3 London Stock Exchange

The London Stock Exchange (LSE) is a stock exchange located in London, England. It was founded in 1801 and is one of the oldest stock exchanges in the world. The LSE is home to a wide variety of companies from various sectors and industries, and it is one of the largest stock exchanges in Europe. It is a primary listing venue for companies from the United Kingdom and other European countries, and it also lists companies from around the world. The LSE operates several markets, including the Main Market, the Alternative Investment Market (AIM), and the Professional Securities Market (PSM). It also operates some indices, such as the FTSE 100 Index, which is a benchmark index for the performance of the largest 100 companies listed on the LSE. The LSE is regulated by the Financial Conduct Authority (FCA) and is a member of the World Federation of Exchanges (Smith, 1929). It serves as a significant center for the trading of stocks, bonds, and other securities and serves as a significant source of funding for enterprises all over the world.

3.2 The stock market's strategy

The stock market is an investment choice that has the potential for big returns, but it also has a reputation for being very unpredictable and volatile. Thus, formulating a stock market strategy is very necessary to maximize profits while simultaneously reducing risks. In the following paragraphs, we will go over some of the most important factors that should be taken into account before formulating a plan for the stock market.

The stock market is characterized by a high degree of uncertainty and is subject to big price volatility. The ability to assess risk tolerance will be able to help calculate how much danger you are willing to take on and how much money you can afford to lose.

Finally, one of the most important factors in mitigating risk is diversity. Spreading your money out over various firms, industries, and asset classes helps reduce the effect that any one investment's performance may have on your portfolio.

The fourth and last point is that it is critical to invest in the long run. The performance of the stock market over the long run has generally been favorable, even though its short-term

fluctuations may be rather severe. As a result, investors have to have a long-term investment perspective, which enables the growth of their assets over time.

Investors should keep a close watch on the costs and fees associated with their investments. A significant amount of money might be taken out of the profits you get from your investments due to the high fees they incur. When looking for ways to save costs, one strategy is to invest in exchange-traded funds (ETFs) or low-cost index funds.

3.2.1 Fundamental Analysis

Fundamental analysis is a method of evaluating the intrinsic value of an asset by examining its underlying economic and financial factors (Baresa, et al., 2013).

This approach to investment and decision-making involves looking at a company's financial statements, such as its income statement, balance sheet, and cash flow statement, to assess its financial health and performance. In the context of stocks, fundamental analysis can be used to evaluate the prospects of a company and its stock price (Greig, 1992).

It involves looking at various financial metrics, such as earnings per share, price-to-earnings ratio, and debt-to-equity ratio, to determine the value of a company's stock (Patricia M, et al., 2001).

Fundamental analysis can also be used to evaluate other types of assets, such as real estate, commodities, and currencies.

It is often used in combination with technical analysis, which involves analyzing historical price and volume data to identify trends and patterns, and to make investment decisions.

To determine an asset's intrinsic value through fundamental analysis, many methods can be used:

Bottom-up strategy: Instead of focusing on the entire market or industry, this strategy examines the financial and operational aspects of a given company or asset (Oberlechner, 2002). This strategy might help find undervalued or ignored businesses that might present lucrative investment opportunities.

Top-down strategy: This entails assessing the general market and economic conditions to spot industries or areas that could present profitable investment opportunities (Yan &

Zheng, 2017). This method can help spot macro trends and adjust a portfolio's positioning.

Discounted cash flow (DCF) analysis: This entails assessing the projected future cash flows from an asset and then discounting them using a needed rate of return to get them back to the asset's current value.

Comparable company analysis: compares a company's financial parameters to those of other companies in a comparable industry to estimate its relative value.

The dividend discount model: calculates the current value of an organization's future payouts based on the supposition that they will increase at a specific rate (Rutterford, 2004).

Price-to-earnings ratio (P/E ratio): This measures the value investors are willing to pay for each dollar of earnings by dividing a company's stock price by its earnings per share (Freihat, 2019).

Price-to-book ratio (P/B ratio): This measures the price investors are ready to pay for each dollar of assets by dividing a company's stock price by its book value (total assets minus liabilities) (Welker & Pae, 2006).

The enterprise value-to-earnings before interest, taxes, depreciation, and amortization (EV/EBITDA) ratio: calculates the value investors are willing to pay for each dollar of earnings by dividing a company's enterprise value (market value of stock plus net debt) by EBITDA.

3.2.2   Technical analysis

Technical analysis is a technique for assessing securities that involve looking at market data such as historical prices and volume. Its foundation is the notion that market patterns, as depicted on charts and other technical indicators, can forecast future activity. Charts and other tools are used by technical analysts to spot patterns and trends that can point to buy or sell opportunities. Technical indicators like moving averages, the relative strength index (RSI), and Bollinger bands are used to spot these patterns and trends. Technical analysts do not attempt to measure a security's intrinsic value but instead use charts and other tools to identify patterns and trends that can suggest buy or sell opportunities

Fundamental analysis, which considers a company's financial and economic fundamentals to estimate its intrinsic value, frequently works in tandem with technical analysis. Technical analysis focuses on the market's perception of that value and how it is represented in the price of the securities, whereas fundamental analysis concentrates on the actual value of a company (Farias Nazário, et al., 2017).

There are many different types of technical analysis, including:

Trend analysis: This involves identifying the overall direction in which a security's price is moving, such as up, down, or sideways (Hess, et al., 2001). Trend analysis can be used to identify long-term trends as well as short-term fluctuations.

Chart patterns: This involves identifying patterns in a security's price movement, such as head and shoulders, double tops and bottoms, and flags and pennants. These patterns can suggest potential reversals or continuations in the price trend.

Moving averages: This involves plotting the average price of a security over a certain period, such as 50 days or 200 days (Holt, 2004). Moving averages can help to smooth out short-term fluctuations and identify longer-term trends.

Oscillators: This involves using technical indicators that fluctuate between two extreme levels, such as the relative strength index (RSI) or the stochastic oscillator. Oscillators can help to identify overbought and oversold conditions in the market.

Volume analysis: This involves analyzing the volume of trading in security to identify buying and selling pressure (Mahajan & Singh, 2008). High volume can indicate strong interest in a security, while low volume can suggest a lack of interest.

Sentiment analysis: This involves using technical indicators to measure the overall sentiment in the market, such as fear or greed. Sentiment analysis can help to identify potential trend reversals.

3.2.2.1 Dow Theory

Dow theory is a theory of market analysis that was developed by Charles Dow, co-founder of Dow Jones & Company and the editor of the Wall Street Journal. The theory is based on the idea that the stock market moves in trends, which can be identified and tracked by analyzing the price and volume of stocks.

According to Dow's theory, there are three primary types of trends in the stock market: primary trends, secondary trends, and minor trends.

Primary trends are long-term trends that last for several months or even years. These trends are typically characterized by a series of higher highs and higher lows (in an uptrend) or lower highs and lower lows (in a downtrend).

Secondary trends, also known as "corrections," are shorter-term trends that move against the primary trend.

These trends typically last for a few weeks to a few months and are characterized by a series of lower highs and higher lows (in an uptrend) or higher highs and lower lows (in a downtrend).

Minor trends, also known as "reactions," are short-term trends that last for a few days to a few weeks. These trends are typically characterized by small price movements that are generally within the range of the primary trend.

According to Dow's theory, the direction of the primary trend can be determined by analyzing the movements of the industrial average, the transportation average, and the utility average. If all three of these averages are moving in the same direction, it is considered a confirmation of the primary trend. However, if one of the averages is moving in the opposite direction, it is considered a non-confirmation and may indicate a potential change in the primary trend.

According to Dow's theory, the primary trend of the market can be divided into four phases: accumulation, markup, distribution, and decline (Prabakaran & Krishnaveni, 2016).

Accumulation: This is the first phase of the primary trend, and it is characterized by low volume and price consolidation. During this phase, smart money (professional investors) begins to accumulate positions in the market, often buying up undervalued stocks at discounted prices.

Markup: In the markup phase, the market begins to trend upward as retail investors (individual investors) become more confident and begin to buy into the market. The volume of trading increases, and the price of stocks start to rise.

Distribution: The distribution phase is characterized by high volume and a slowing of the uptrend. Smart money begins to sell off their positions, often to retail investors who are still optimistic about the market.

3.3 Analysis of charts

Chart analysis, also known as technical analysis, is a method of evaluating financial markets by studying past price and volume data (Prado, et al., 2013). The goal of chart analysis is to identify patterns and trends in the market and to use this information to make informed investment decisions.

In chart analysis, traders and analysts use various tools and techniques, such as charts, trend lines, moving averages, and oscillators, to identify and interpret patterns in the market (Taylor & Allen, 1992).

They may also use fundamental analysis, which involves evaluating a company's financial and economic data, to supplement their technical analysis. There are many different chart patterns and indicators that technical analysts may use in their analysis (Leigh & Hornik, 2007). Some common examples include head and shoulders, double tops and bottoms, trend lines, moving averages, and relative strength index (RSI)

3.3.1 Chart formats

Several types of charts are commonly used in technical analysis:

Line chart: A line chart is a simple type of chart that plots a series of data points connected by straight lines. It is often used to show the general trend of a data series over time.

Bar chart: A bar chart is a chart that uses horizontal bars to represent the different data points in a series. The length of the bar represents the magnitude of the data point, while the horizontal position of the bar represents the period.

Candlestick chart: A candlestick chart is a chart that uses candles to represent the price movement of a security over a specific period. Each candle represents the range of prices for the period, with the body of the candle representing the range between the opening and closing prices. The wicks of the candle represent the high and low prices for the period.

Point and figure chart: A point and figure chart is a chart that uses X's and O's to represent price movements.

X's represent rising prices, while O's represent falling prices. The chart is constructed by plotting a column of X's or O's whenever the price moves a certain number of points in either direction.

Renko chart: A Renko chart is a chart that uses bricks of a fixed size to represent price movements. The bricks are placed on the chart whenever the price moves a certain number of points in either direction. This type of chart is useful for filtering out noise and identifying long-term trends.

3.3.1.1 Line chart

A line chart is a type of graph that displays data as a series of data points connected by straight lines.

It is often used to visualize data that changes over time, such as stock prices or temperature data. Line charts can also be used to show trends or patterns in data, such as the relationship between two variables.

To create a line chart, you will typically start by plotting data points on a graph, with the horizontal axis representing the variable being measured and the vertical axis representing the values of that variable. You will then draw a straight line connecting the data points to show the overall trend or pattern in the data. Line charts can be used to display data for a single variable or multiple variables, and they can be customized with various options, such as the type of line, the color of the line, and the axis labels

Figure 1. Line chart of MicroStrategy stock

Source: own processing, 2023

3.3.1.2 Bar chart

A bar chart or bar graph is a graphical display of data using bars of different heights. It is a way to visualize data in a way that allows you to see the relative sizes of different data sets. The bars in a bar chart can be either vertical or horizontal, and the length or height of the bars represents the magnitude of the data being plotted Blum-sik & Sang-up, 2017. Bar charts are often used to compare data across different categories or to show how a value has changed over time. They can also be used to display statistical information, such as mean, median, and mode.

To create a bar chart, you will need to gather the data that you want to represent and arrange it in a tabular form, with rows representing different categories and columns representing different data series or groups.

You can then plot the data by drawing a bar for each category, with the height of the bar corresponding to the value within that category. You can also add labels to the bars to identify the categories and data series and add a title to the chart to provide context.

In the stock market, a bar chart is a type of chart that is used to visualize the performance of a stock over a specific period. It is a graphical representation of the stock's price action, with the horizontal axis representing the period and the vertical axis representing the stock's price.

A bar chart typically consists of a series of bars, each representing the price movement of the stock over a specific period. The width of the bar represents the duration of the period, and the height of the bar represents the price movement of the stock over that time. The top of the bar represents the highest price that the stock reached during that time, and the bottom of the bar represents the lowest price.

Figure 2. Bar chart of MicroStrategy

Source: own processing, 2023

Bar charts are used to visualize the price action of a stock over a specific period and to identify trends and patterns in the stock's performance. They can be used to analyze the stock's price movements and to make informed trading decisions.

3.3.1.3 Candlesticks chart

Candlestick charts are a type of financial chart that has a long history dating back to 18th century Japan. They were originally developed by Japanese rice traders to visualize the price movements of rice and were later adopted by the Japanese stock market in the 1870s.

Candlestick charts became popular in the West in the late 1980s and early 1990s, when Steve Nison, a financial analyst, and author, introduced them to a wider audience through his book "Japanese Candlestick Charting Techniques." Since then, they have become a popular tool among traders and investors worldwide.

Candlestick charts are based on an ancient Japanese charting technique known as "renko" which means "brick" in Japanese.

Renko charts were used to visualize the price movements of rice by plotting a new "brick" on the chart whenever the price moved a certain amount.

Candlestick charts are similar to renko charts in that they visualize the price action of a security over a specific time, but they also include information about the security's opening and closing prices.

Candlestick charts are now widely used in the financial industry to visualize the price movements of a variety of securities, including stocks, bonds, and commodities (Ananthi & K., 2021).

They are a popular tool among traders and investors because they provide a wealth of information about the price action of security in a compact and easy-to-understand format.

Figure 3. Candle chart of MicroStrategy stock

A candlestick chart is a type of chart that is used to visualize the price action of a stock or other financial instrument over a specific period (Lee & Jo, 1999). It is a graphical representation of the stock's price movement, with the horizontal axis representing the time and the vertical axis representing the stock's price.

A candlestick chart consists of a series of candlesticks, each representing the price movement of the stock over a specific period. The body of each candlestick represents the range of price movement over time, with the top of the body representing the highest price and the bottom of the body representing the lowest price (Varadharajan & Vikkraman, 2011). The wicks, or shadows, of the candlestick, represent the highest and lowest prices reached during the period, even if they were not the closing price.

Candlestick charts are used to visualize the price action of a stock or other financial instrument over a specific period and to identify trends and patterns in the stock's performance.

3.3.2 Trendlines and trend channels

A trendline is a line drawn on a chart to show the underlying trend in a stock's price. It is typically used to identify the overall direction in which the stock's price is moving, as well as to help identify support and resistance levels. To create a trendline,

you would first need to identify the trend in the stock's price. This can be done by looking at the stock's price over a specific period and determining if it is generally moving upwards, downwards, or remaining relatively stable.

Trendlines can also be used to identify support and resistance levels, which are price points where the stock is likely to find support (and potentially reverse its downward trend) or resistance (and potentially continue its upward trend) (Caginalp & Balenovich, 2002). Knowing these levels can be useful for setting stop-loss orders, which can help to limit potential losses in case the stock moves in an unexpected direction.

In addition, trendlines can be used to identify potential entry and exit points for trades. For example, if a stock is in an uptrend and is approaching a resistance level, an investor may consider selling the stock or taking profits. On the other hand, if a stock is in a downtrend and is approaching a support level, an investor may consider buying the stock or holding onto it in the hope that the trend will reverse.

Once the trend has been identified, you can then draw a line on the chart that connects the most relevant high and low points in the trend (Guilizzoni, 2022). This line can help you visualize the direction in which the stock's price is moving, as well as identify potential support and resistance levels.

A trend channel is a type of technical analysis tool that shows the direction and strength of a trend in a financial market, like the stock or currency market. It is typically represented on a chart as a pair of parallel lines that act as support and resistance levels, with the trend direction indicated by the angle of the lines. The channel is created by drawing a line that connects a series of highs or lows and then drawing a parallel line a certain distance away. Most of the time, the distance between the two lines is based on how volatile the market or security being looked at is. Trend channels can be used to identify potential entry and exit points for trades and to set stop-loss orders.

To use a trend channel to trade, you must first find the direction of the trend. This can be done by looking at a chart and figuring out whether the price action is in an uptrend, a downtrend, or a trading range.

Once you've found the trend, you can draw the trend channel by connecting the highs and lows of the price action and drawing parallel lines above and below the trend. When prices are moving in a trend within the channel, the upper and lower lines can be used as entry and exit points for trades. One way to trade with a trend channel is to buy at the bottom line and sell at the top line. You can also set stop-loss and take-profit levels with the trend channel. Place the stop-loss order just below the lower line and the take-profit order just above the upper line. Watch for breakout and reversal signals. For example, if the price breaks out of the trend channel, it could mean that the trend is about to change. This is a good time to get out of a trade or start a new one in the opposite direction. More importantly, keep an eye on the volume. Volume is an important part of trading with trend channels because it shows how strong the trend is. High volume means that the trend is strong and likely to keep going, while low volume means that people aren't interested and that the trend could turn around.

3.3.3   Support and Resistance

A resistance level in trading is a price point above which the price of an asset is hard to go up. This can happen if a lot of traders have put in sell orders at or close to that price. When the price of the asset reaches the resistance level, the selling pressure may cause the price to stop going up or even go down. Resistance levels are often used by traders as a sign to take profits or open short positions (Chan, et al., 2022).

In trading, a support level is a price point below which a stock or other asset is thought to have a hard time falling. This is often because there is a lot of pressure to buy at that price. Traders may use support levels as a sign to go long or stay in their current long positions (Zapranis, 2012).

On the stock market, the way that prices change over time shows how support and resistance levels work together. An example is when a stock that has been trading between $50 (its support level) and $55 (its resistance level) for a long time.

If the stock price breaks above the resistance level, it could mean that the stock is in a bullish trend, which could lead traders to buy more shares. On the other hand, if the stock price drops below the support level, it could be a sign of a bearish trend, and traders may decide to short.

Figure 4. Resistance and Support level of MicroStrategy Stock

A stock that has been going down and just made a new 52-week low, the recent low may now act as a support level. If the price bounces off this level, traders may see this as a sign that the stock is starting to turn around and enter long positions.

A stock that has been going up and recently reached a new 52-week high is said to be in an uptrend. The recent high may now act as a resistance level. If the price doesn't break above this level, traders may see this as a sign that the stock is reaching its peak and enter short positions or take profits.

3.3.4   Technical Analysis Graphic Formations

The patterns that are visible on a financial chart, such as a stock chart or any kind of financial chart, are referred to as "graphic formations." Technical analysts make use of these patterns to determine whether or not the current market conditions are favorable for buying or selling. Graphic formations include the head-and-shoulders pattern, the double top-and-bottom pattern, and the flag and pennant pattern, to name a few examples. These patterns are essential for understanding the behavior of the market and making intelligent judgments on investments.

The head and shoulders pattern is one of the types of chart patterns that are utilized the most often. The pattern got its name from the fact that it looks like a head with two shoulders attached to it. It is a dependable sign of a shift from a bullish trend into

a negative trend in the market. The formation of this pattern often occurs after an uptrend has come to an end and the price of an asset has reached a high before beginning a downward trend. Three peaks make up the head and shoulders pattern, with the second peak being the tallest of the three. The shoulders are formed by the two lesser peaks that are located on each side of the primary peak.

When the price drops below the neckline, which is a line drawn connecting the two valleys that create the shoulders, the pattern is said to have been completed successfully. When the neckline is broken, it indicates a change from a bullish to a negative feeling in the market, and investors may consider selling their holdings or buying short positions as a result.

The double top and bottom is another variation that is often used. This pattern manifests itself when the price of security climbs to a new high or falls to a new low twice before reversing the trend it had been following. When a price hits a high twice, with a decrease in between each peak, a double top pattern has formed in the market. In contrast, a double bottom pattern is formed when a price hits a low twice in a row, with an increase in price occurring in between each low.

The formation of a double-top pattern indicates a reversal to a bearish trend, while the formation of a double-bottom pattern indicates a reversal to a bullish trend. When the price breaks below the support level of the double top pattern or when the price breaks above the resistance level of the double bottom pattern, it shows that there has been a change in the market attitude, and investors may consider selling or purchasing the asset.

The flag and pennant pattern is yet another common chart pattern that materializes in a market that is moving in a certain direction. This pattern is generated when there is a strong price movement, followed by a short time of consolidation, and then another sharp price movement in the same direction as the first movement. The consolidation phase comes after the initial movement. As a result of its shape, the consolidation phase is often referred to as a pennant or a flag.

A continuation pattern shows a price trend is likely to continue in the same direction. The flag and pennant pattern is an example of a continuation pattern. Because the price is expected to continue in the same way after it breaks out of the flag or pennant shape, technical analysts use this pattern to identify a buying or selling opportunity during a time of consolidation when the price is likely to continue in the same direction.

3.3.4.1 Technical analysis of stock trends

In technical analysis, the head and shoulders pattern on a chart is a sign that the price will go down. It is made when the price of a stock rises to a peak, falls, rises again to a higher peak, and then falls again, making the shape of a head and two shoulders (Lucke, 2004). The "left shoulder" is the first peak, the "head" is the highest peak, and the "right shoulder" is the second peak.

The pattern is finished by a line called the "neckline," This is a horizontal line drawn across the bottoms of the left shoulder, head, and right shoulder, and is used to confirm the pattern. The formation of this pattern suggests that the stock's price has been going up, but that buyers are losing control, and selling pressure is going up. When the price of the stock falls below the neckline, traders usually start short positions or sell long positions they already have. This is because the price drop is seen as confirmation of the pattern.

3.3.4.2 Double Top and Bottom

A double top and bottom are a pattern in technical analysis that can be used to spot a possible change in the stock market's trend. The pattern is made when the price of a stock goes up, drops, and then goes back up to the same high point. This makes a "W" or "M" shape on the stock chart.

Figure 5. Double bottoms and tops
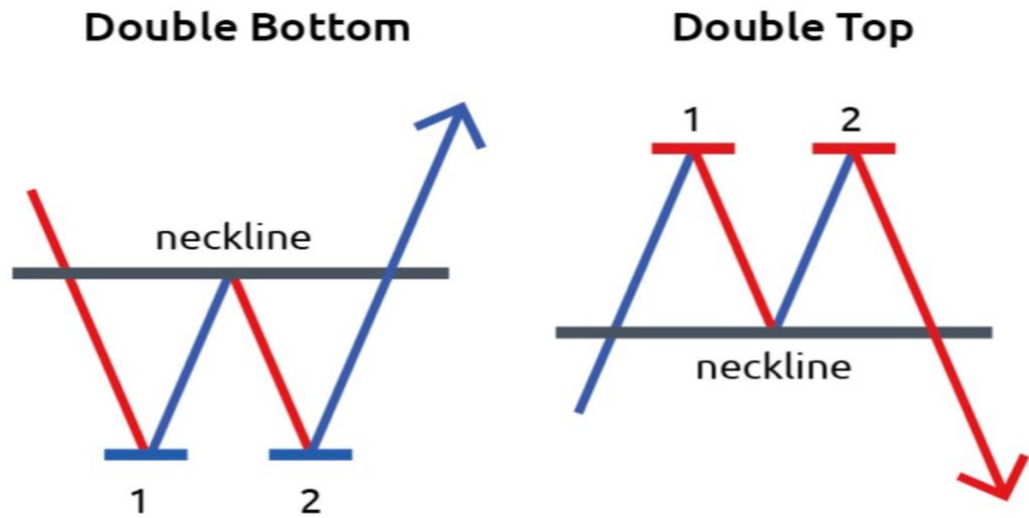
The double-top pattern is a bearish reversal signal, which means that it shows that a stock that has been going up is likely to change direction and start going down. A double bottom pattern is a bullish reversal signal, which means that it shows that a stock that has been going down is likely to change direction and start going up.

Usually, the following things can be used to describe the pattern:

Two peaks or valleys: There are two peaks or valleys in the pattern, with the first one being the highest or lowest.

Neckline: The neckline is made by drawing a line across the bottom of the first peak or the top of the first valley. This line is used to confirm the pattern because it shows a key level of support or resistance.

Volume: During the formation of the pattern, the volume usually goes down as the price forms the two peaks or troughs. This shows that the pressure to buy or sell is going down.

Break of the neckline: The pattern is confirmed when the price breaks through the neckline. This is seen as a sign that the stock is likely to reverse and start moving in the opposite direction.

Targets: Once the pattern is confirmed, the distance between the first high or low and the neckline is used to figure out possible price targets for the stock.

3.3.4.3 Flag and Pennant Pattern

The flag and pennant pattern is a type of technical analysis that can be used to see if a stock market trend is likely to continue. After a strong price move, the pattern is made by a short period of consolidation or retracement. On a stock chart, it looks like a flag or a pennant.

Figure 6. Chart of flag and pennant pattern

Source: tradingpedia.com, 203

The flag and pennant pattern is a bullish or bearish continuation signal, which means that it shows that a stock that has been going up or down is likely to keep going in the same direction. The pattern is made up of two trendlines that connect the highs or lows of the retracement period and slope in the opposite direction of the previous trend.

- The flagpole is the first big move in price that happens before a flag or pennant pattern forms.
- The flag or pennant is the short-term period of consolidation or retracement that comes after the flagpole. It's made up of two trendlines that connect the highs or lows of the retracement period and slope in the opposite direction of the previous trend.
- Volume: During the formation of the pattern, the volume usually goes down, which shows that the pressure to buy or sell is going down.
- Break of the upper or lower trendline: The pattern is considered confirmed when the price breaks through the upper or lower trendline of the flag or pennant. This is a sign that the stock is likely to keep going in the same direction.

- Targets: Once the pattern is confirmed, the distance between the start of the flagpole and the top or bottom trendline of the flag or pennant is used to figure out possible price targets for the stock.

3.3.5 Why Invest in Bitcoin?

Bitcoin is a kind of cryptocurrency that has received a lot of attention and garnered a lot of popularity over the last few years. The possibility of significant returns on investment is one of the factors contributing to this phenomenon. Bitcoin has a history of seeing sudden and significant price gains over a very short time. As a result, purchasing Bitcoin represents a potentially lucrative investment opportunity.

Bitcoin is appealing to investors because it is a decentralized currency that functions on a peer-to-peer network. This means that there is no central authority or government that regulates it, which makes it possible for users to transact freely without interference. Because it is not controlled by any one institution, Bitcoin is resistant to inflation because there is no central authority that can issue more of the money. Investors who are worried about the effects of inflationary pressures on conventional currencies are likely to find this feature to be especially appealing.

Because there are only 21 million Bitcoins in circulation, investing in them is becoming more popular. Because there can never be more than 21 million Bitcoins in circulation, this digital money can never reach its full potential. It is anticipated that the rising demand would cause the price of Bitcoin to rise due to the restricted supply.

Some investors consider bitcoin to be a safe-haven asset because of its decentralized nature. In times of economic instability, some investors look to Bitcoin as a store of value, similar to the way they could invest in gold or other precious metals. This is because Bitcoin is decentralized and cannot be controlled by a central bank. Because Bitcoin is not connected to any one government or financial institution, it is more resistant to political and economic upheaval than other currencies.

In addition to these advantages, investing in Bitcoin is rather straightforward. Bitcoin may be purchased by investors via various exchanges and trading platforms, and the cryptocurrency can then be stored in a digital wallet. Because of its accessibility, even novice investors can get their feet wet in the Bitcoin market.

Investing in Bitcoin, on the other hand, is not without its hazards. Bitcoin is a highly volatile asset, which means that its value may substantially vary in a short period. This is because Bitcoin was created using cryptography. The value of investment might experience dramatic shifts, so investors need to be ready for this possibility.

In conclusion, individuals invest in Bitcoin because of the possibility of large profits, its limited supply, its decentralization, and the sense of protection they get from investing in it during times of economic instability. Even if putting money into Bitcoin is not without its dangers, cryptocurrency is gaining more and more popularity as more people want to profit from the opportunities it presents.

3.3.5.1 Bitcoin as Money

Money has 3 fundamental use cases:

1. A place to store value 2. A way to trade goods 3. A unit of account

Even though price volatility has hurt the value of bitcoin over the years, someone who has held bitcoin since late 2012 would still have kept and grown their wealth. As a store of value, Bitcoin has done quite well, going from $1 in 2011 to about $23,000 as of January 28, 2023. Bitcoin is used nowadays as a means of exchange as it is now both easy and cheap to send large amounts of bitcoin from one person to another around the world, and the Lightning Network makes it possible to make micropayments with almost no fees (Hazlett & Luther, 2020). Bitcoin can be used as a standard for pricing items to try to figure out if their prices have gone up or down. Bitcoin is used as a unit of account in the Cryptocurrency community by altcoins as a price benchmark to show how their values change. Bitcoin is also used as a unit of account in the following ways:

Miners have to think about whether or not a mining rig will make more bitcoin than it costs.

Online stores set the prices of their items in terms of bitcoin (or Satoshi's - 100 millionth of a bitcoin).

Bitcoin can be used to keep track of how much electricity is used by figuring out how many watts are used per bitcoin.

When the price of bitcoin goes up, the price of things in bitcoin goes down, which usually means you can buy more things with bitcoin.

3.3.5.2 Bitcoin as store of value

For something to be considered a good store of value, it needs to keep its value over time. For this to happen, it needs to be independent in its valuation and supply from any central authority, such as governments, banks, or other organizations, so that the value doesn't change over time because of supply interference and other ways of controlling value (Baur & Dimpfl, 2021).

In the case of Bitcoin, the fact that it is decentralized, open, and hard to censor, and that its supply is fixed, are what keep its value.

Any kind of devaluation or supply manipulation or change, with or without the help of a central force, can't happen outside of the strict rules set by the protocol itself. Gold and other assets like it have the same quality that no one central authority can change their value much, which helps them keep their value over time.

Gold has always been controlled by a small number of people, whether they are aristocrats, monarchs, or central banks. This weakness has been used over and over again throughout history. It wouldn't be too much of a stretch to say that this is because of the cycles of wealth transfer from existing gold holders to new gold holders. This mostly happened when large amounts were taken from existing gold holders, usually through theft, rather than through business activities. Bitcoin, on the other hand, doesn't have the same centralization problems as gold and has, for the first time, made it so that central or state actors can't interfere with monetary policy (Van Alstyne, 2014).

Also, a Cryptocurrency that has little to no utility value but has all the open, decentralized, censorship-resistant properties that improve and to some extent guarantee value retention would probably lose value over time because there is no base (utility) value to hold or keep that value over time.

The skeptic may still have questions about the underlying utility value of an asset like Bitcoin. Suffice it to say that the underlying utility value of Bitcoin is in how well it fulfills its promised use case, which is Internet Money. We can say it has done in a large part because anyone from anywhere in the world can trade money openly and freely and also keep their money safe with Internet Money.

So far, we've seen and continue to see large increases in its utility value. This is mostly because more people are using it, which causes its speculative value and overall value to go up. This keeps the value going up and up over time. This rise in Bitcoin use can be traced to the following benefits that long-term investors get from Bitcoin:

-Exposure to gains from speculative trading.

-Asset seizure resistance: The government can't take someone's property.

- A way to protect against possible future bank crises and inflation of the currency

3.3.5.3 Bitcoin Returns

A quick look at Bitcoin's better returns Year-to-Date (YTD) over the past 10 years compared to other asset classes shows the different returns it has been able to give to early adopters and those willing to take on more risk who bought in early, despite its swings.

Even though Bitcoin fell from its all-time high of $20,000 in December 2017, it was still down about 83% YTD ($3,230 on Bitstamp in December 2019) at the end of 2018. The price, on the other hand, went up to a yearly high of $12,000 in July 2019 and ended the year with a 95% return at $7,200. Gold's average return so far this year is only 18%, which is much less than Bitcoin's return of 95%.

Bitcoin, on the other hand, has confused investors who have been saying "Bitcoin is dead" for the past ten years. To their dismay, Bitcoin has been the best-performing asset over the last ten years.

The first-time bitcoins were traded for money was on October 12, 2009. 5,050 bitcoins were traded for $5.04, giving us a rate of 1 bitcoin to $0.00099. On February 9, 2011, the price of a bitcoin reached $1.

In July 2010, Bitcoin was worth about $0.07, but as of January 2020, it is worth about $7,200. If you put $1 into Bitcoin in July 2010, it would be worth more than $90,000 today. This is a return on investment of more than 9,000,000% in 10 years.

3.3.5.4 Bitcoin Portfolio Allocation

From the point of view of an investor, the author argues that Bitcoin could be a great haven during economic downturns or recessions and could be used to get out of riskier assets like traditional stocks (Ghabri, et al., 2020). But investors still don't trust Bitcoin enough for it to be seen as a good way to protect against an economic downturn. After proving itself to be the best-performing asset of the last 10 years, Bitcoin is likely to get the support it needs from investors to become a good long-term store of value.

For now, putting 3% or more of a traditional investment portfolio into Bitcoin can significantly reduce drawdown risk and increase overall returns. This is because Bitcoin has a low correlation with most traditional asset classes, including Gold.

Gold and Bitcoin don't seem to be related to each other at all, which might seem strange given that they are both good ways to store value and protect against economic uncertainty (Wu, et al., 2019). But this could be because of how risky people think Bitcoin is. Many investors still see Gold as the safer investment. Even though Bitcoin was the best-performing asset of the decade, investors would have to re-evaluate its risk profile if it kept doing so well and investors learned more about it.

3.3.6 MicroStrategy Bitcoin Investment

MicroStrategy made news in August 2020 when it reported that it had acquired 21,454 Bitcoin for a total price of $250 million. This marked MicroStrategy as the first publicly-traded corporation to invest a large percentage of its treasury assets in Bitcoin. At that time, MicroStrategy has made more investments in Bitcoin, and the company currently has a total of more than 90,000 Bitcoin, which had a value of more than $5 billion as of March 2023. The question, therefore, is: why did MicroStrategy choose to invest in bitcoin?

Hedging Against Inflation

MicroStrategy's investment in Bitcoin might be seen as a hedge against the company's principal concern, which is inflation. Michael Saylor, the Chief Executive Officer of MicroStrategy, has been quite outspoken about the worries he has about the possibility of inflation as a result of the extraordinary monetary policies and stimulus packages that have been undertaken by governments all over the globe. When interest rates are historically low,

cash reserves held in a company's treasury may experience value erosion as a result of inflation. Because of Bitcoin's limited supply and its deflationary character, it has the potential to be used as a hedge against inflation, and MicroStrategy is using this potential to its advantage by investing in Bitcoin.

Diversification

In addition to providing a means to diversify its investment portfolio, MicroStrategy has invested in Bitcoin. MicroStrategy, which is in the software business, has huge cash flows coming in, which the firm may then spend on a variety of other assets. MicroStrategy is increasing its asset diversification and lowering its exposure to risks associated with a single asset class via the company's decision to invest in Bitcoin. Bitcoin is a non-correlated asset, which means that its value is not impacted by the performance of other assets. Because of this, it is a great hedge against market volatility since its value is not affected by the performance of other assets.

The Possibility of Accumulating Large Profits

MicroStrategy saw the potential for large returns on its investment, which is another reason the company decided to purchase Bitcoin. The value of one bitcoin increased from less than one dollar in 2010 to more than $60,000 in 2021, demonstrating tremendous development over the course of the last several years. MicroStrategy believes that the potential for significant profits offered by Bitcoin more than makes up for the dangers that are connected with investing in Bitcoin. MicroStrategy has the financial freedom to make investments in high-risk, high-reward assets like Bitcoin because the firm produces considerable cash flows.

Innovation

Michael Saylor, the Chief Executive Officer of MicroStrategy, has made no secret of the fact that he thinks Bitcoin has the potential to be used in the long run as both a store of value and a means of exchange. He believes that Bitcoin is a significant technical advancement that has the potential to revolutionize the way that we store and transmit money. MicroStrategy is establishing itself as a firm that is at the forefront of innovation and technical growth via its investment in the cryptocurrency Bitcoin.

Investor Demand

The desire from MicroStrategy's investors was another factor that played a role in the company's decision to invest in Bitcoin. MicroStrategy discovered, via the administration of a survey to its investors, that a significant proportion of those individuals had an interest in investing in Bitcoin. By making Bitcoin investments, MicroStrategy is not only meeting the demands of its existing investors, but it is also opening the door to prospective new investors who share an interest in Bitcoin.

To summarize, MicroStrategy invested in Bitcoin as a hedging strategy against inflation, a means to diversify its investment portfolio, an opportunity to potentially earn high returns, a means to position itself as an innovative company, and a means to satisfy the demand from its investors. While there are dangers associated with investing in Bitcoin, MicroStrategy feels that the profit opportunities much exceed those dangers. MicroStrategy has established itself as a leading participant in the cryptocurrency industry as a result of its significant Bitcoin investments. As a result, other businesses now look to MicroStrategy as a model to emulate.

4 Practical Part

Two trading techniques make up the practical section of this work. The first uses Bollinger Bands and Volume indicator, while the second uses the Relative Strength Index (RSI). The Trading View platform offers to trade in MicroStrategy stock.

4.1 MSTR trading strategy based on Bollinger Bands and the volume indicator

The trading strategy is built on a multi-stage process that takes into account Bollinger bands and the Volume indicator.

First and foremost, we must agree on the **definition of a trend**. One of the primary assumptions of technical analysis is that prices will continue to move in line with an established trend until the trend begins to show signs of reversing. In technical analysis, a trend is the predominant long-term direction of price movement. Traders and investors use trends to forecast the market movement and capitalize on favorable buying and selling opportunities. Trends can be up (bullish), down (bearish), or sideways (neutral). Technical analysts utilize tools like trend lines and moving averages to evaluate the strength and direction of a trend to make profitable investment decisions. For our analysis, Bollinger bands will be used to signal both strong and low volatility. Broad bands imply strong volatility, whereas narrow bands suggest low. As a rule of thumb, an upward trend is indicated when prices are above the moving average, while a downward trend is indicated when prices are below the average. Moreover, a shift in trend could be signaled by a breakout above or below the bands. Overbought and oversold situations are possible when the price reaches the upper band and the lower band, respectively.

Secondly, there is the need to identify a signal to **open a position**. Opening a position when the Bollinger Bands are contracting and the price is consolidating is called a "Bollinger Bands Squeeze," and it's used to anticipate a possible breakout in either direction. When the price moves above the Bollinger Band's upper boundary, traders may decide to buy, and when it moves below the lower boundary, they may decide to sell. Opening a position when the price reaches the outer Bollinger Bands is part of the Bollinger Bands Reversion to Mean trading technique since it often foreshadows a return to the mean. When the price moves up to the higher Bollinger Band, traders often sell, and vice versa when the price moves down to the lower Bollinger Band. After

identifying the entry signal, the Volume indicator should be used to verify the received signal.

Figure 7. Representation of buy signal

Source: Own processing, 2023

Figure 8. Representation of sell signal

Source: Own processing, 2023

Thirdly, the Dow theory suggests that volume can be used to verify a trend. if you want to verify a trend based on volume, you need to figure out if the quantity of trades backs up the direction of price movement. When volume rises alongside a trend in pricing, it's sometimes taken as further evidence that buyers or sellers are strongly supporting the trend. Contrarily, a lack of confidence in the trend, as indicated by a drop in volume as prices change in a specific direction, may point to a reversal or correction.

Finally, place a stop loss and take profit. There is a need to determine a stop-loss point that makes sense. This might be a level of market support or resistance, or it may be a certain price level that is considered to represent the most money that could be lost.

To be able to set a take profit there is the need to identify the price level at which you would like to lock in your profits. To create a take-profit, you need to establish the price point at which you desire to tie in your profits. This might be a significant level of

resistance, a particular proportion of profit, or any other price level that may be considered to be an acceptable target.

Implementation Details of this trading strategy

1. The amount of the initial deposit is 100,000 USD. the transaction cost is 0.01% of the total for one trading day.

2. The order size for each long position is 100, 000 USD

3. The time range chosen is from January 1, 2012, to December 31, 2021

4. A buy signal is generated when the closing price candle crosses the middle line of the Bollinger bands and the closing price is below the upper band

5. A sell signal is generated when the price candle breaks over the middle line of the Bollinger bands and the closing price is above the lower band.

6. We close from a position when the closing price is below the middle line of the Bollinger bands. Closing prices closing below the middle line may indicate a change of trend. Closing out on long positions helps to preserve gains or cut losses short.

The outcomes achieved as a result of carrying out Bollinger bands trading strategy

The following findings were obtained through examination of the specified period, and they are shown in the table that can be seen below (Figure 3):

Table 1. Results of Trading Strategy Based on Bollinger Bands

Initial Deposit	100, 000 USD	**Profit Factor**	1.927
Net Profit	264, 712.813	**Average Trade**	1,825.61
Total Closed Trades	145	**Max Drawdown**	84, 235.56
Percent Profitable	26.21%	**Average Number of Bars in Trades**	11

Source: Own processing, 2023

Figure 9. Equity curve of trading strategy based on Bollinger Bands

Source: Own processing, 2023

Evaluation And Optimization of the Bollinger Trading Strategy.

After obtaining the results, it is necessary to analyze the trading strategy to determine its strengths and weaknesses, both of which need to be analyzed and improved. The current state of our strategy does not take into consideration profit taking and a stop loss. The strategy just enters a position and holds until a signal is triggered to change position.

To achieve optimization, it is necessary to introduce a new parameter. The parameters under consideration will involve:

- Optimization based on the setting stops loss and takes the profit.
- Optimization based on mean reversion

4.1.1 Optimization Based on Setting Stop loss and Take Profit

Traders can better control their positions and reduce the likelihood of incurring losses by including stop loss and take profit levels in their trading strategies. This is an important risk management method. The following are some of the primary justifications for why a trading strategy needs to incorporate stop loss and take profit levels:

1. Stop loss levels are used to limit possible losses by automatically ending a position if the price swings against the trader. This keeps the trader from being subject to

55

further losses. A losing position might continue to generate losses and leave the trader exposed to a large risk of loss if there is not a stop loss in place.

2. Take-profit levels allow traders to protect their winnings by automatically exiting a position when the price exceeds a certain threshold at which point the take-profit level is triggered. A winning position can continue to earn gains even in the absence of a take profit, but the trader runs the risk of missing out on the opportunity to lock in those profits if the price makes a turn for the worst.

3. Having a trading plan that incorporates stop loss and take profit levels will assist traders in better managing the risk of each position by employing a risk management strategy known as stop loss and take profit levels. This is an important risk management approach. Traders can guarantee that their risk exposure is in line with their risk management plan if they first set acceptable levels and then monitor those levels. Several factors go into determining the stop profit and loss in a trading strategy. The "take profit" level should be determined based on the current conditions in the market. These conditions should include volatility, liquidity, and the direction of any existing trends. To prevent missing out on potential opportunities to lock in profits due to the market's volatility, the "take profit" level may need to be adjusted downward. When there is less volatility in the market, the "take profit" level can be increased.

The take-profit level ought to be determined following the willingness to take risks. A trader who is more comfortable taking risks may choose to establish a higher take profit level, while a trader who is more risk averse may choose to set a lower take profit level. Both traders' goals are to guarantee that they lock in profits.

For our use case, we will set a take profit of 2% and a stop loss at 2%. In general, a take-profit level of 2% can be considered a reasonable target in a market that varies between moderate and low levels of volatility. However, in a highly volatile market, a 2% take profit level may be too low, and the trader may need to select a higher take profit level to capture larger price changes

Table 2. Results of Trading Strategy after Optimizing for Take profit and Stop Loss

Initial Deposit	100, 000 USD	Profit Factor	1.104
Net Profit	18,638.98	Average Trade	133.14
Total Closed Trades	140	Max Drawdown	38,597.64
Percent Profitable	51.43%	Average Number of Bars in Trades	4

Source: Own processing, 2023

Figure 10. Equity Curve of Bollinger Bands after optimizing for stop loss and take profit

Source: Own processing, 2023

This adjustment increased the percentage of winning trades from 26.21% to 51.43%. However, the amount of money made by this optimization strategy for each unit of money lost was reduced from 1.927 to 1.104. This means that strategy was profitable in winning trades but not a good optimization technique for making more return on investment. This strategy maintained a steady return through the lifespan of this optimization strategy

4.1.2 Optimization Based on Trailing Stops

In technical analysis, one sort of order known as a trailing stop is utilized to reduce potential losses while simultaneously boosting prospective gains. It is a type of stop-loss order that modifies itself automatically according to the fluctuating asset's price on the market.

A standard stop-loss order requires the trader to specify a predetermined price at which they will sell their position if the market swings against them. On the other hand, if you use a trailing stop, the stop-loss order will be placed at a specific percentage or dollar amount below the price that is currently being offered on the market.

If the trader's position improves as a result of a favorable shift in the market price, the trailing stop will automatically adjust higher such that it remains at the predetermined percentage or dollar amount below the market price. Because of this, the trader can lock in profits and limit prospective losses if the market moves against them. Profits can be locked in if the market continues to move in the trader's favor.

Mean reversion is a concept in finance that describes the tendency of asset values to move toward their historical or long-term average over time. This tendency is referred to as the "return to the mean." In other words, if the price of an item is currently higher than its average, then a decline in that price is anticipated shortly, and vice versa.

In this optimization, the trailing stop percent is at 2 %, and the trailing take profit percent is also set at 2%

Table 3. Results of Trading Strategy after Optimizing for Trailing Stop Loss

Initial Deposit	100, 000 USD	Profit Factor	1.137
Net Profit	25,031.87	Average Trade	188.21
Total Closed Trades	133	Max Drawdown	49,183.47
Percent Profitable	54.41%	Average Number of Bars in Trades	4

Source: own processing, 2023

From the above table, it can be observed setting a trailing stop helps improved the result of the previous optimization technique. The net profit factor increased from 18,638.98 to 25,031.87 and the percentage of profitable trade also increased from 51.43 to 54.41%. Overall setting the trailing loss resulted in a massive improvement in the prior optimization technique

Figure 11. Equity Curve After Optimising for Trailing Stops

Source: Own processing, 2023

4.1.3 Optimization Based on changing the length of the Moving Average

The fundamental strategy utilized the following parameters of Bollinger bands: moving average with a period of 20 days, upper and lower border of the bands with two standard deviations from the average, and two standard deviations from the middle band.

John Bollinger carried out considerable research on Bollinger Bands by utilizing a variety of markets and periods. The research included testing on six markets where the 10th, 20th, 30th, and 50th periods were calculated. In his book titled "Bollinger on Bollinger Bands," (Bollinger, 2002) John Bollinger goes into great depth about the findings of his experiments on six different markets, each of which used a distinct period for the moving average that the Bollinger Bands are built on.

He researched the following markets:
- S&P 500 index
- Average of the Dow Jones Industrials
- U.S. Treasury Bonds with a Term of 30 Years
- Gold Crude Oil

- Japanese Yen

He examined the effectiveness of Bollinger Bands with moving averages based on periods of 10, 20, 30, and 50 days. His experiments demonstrated that the time interval chosen for the moving average has the potential to have a considerable bearing on the accuracy of the Bollinger Bands. In general, he discovered that a shorter period generated more signals, but also more false signals, whereas a longer period generated fewer signals, but they were more dependable. This was the case regardless of the length of the period.

In addition, he discovered that the duration of time that was ideal for the moving average changed based on the market that was being traded. For instance, he discovered that the best-moving average to use for the S&P 500 index was a 20-day average, while the best-moving average to use for gold was a 50-day average.

Under John Bollinger's recommendations, you can choose between two different length parameters for optimization.

- The first choice is a 10-day Moving Average with a 1.9 standard deviation for both upper and lower bars.
- The Second Choice's upper and lower bands will both use a moving average of 50 days and a standard deviation of 2.1.

Figure 12. Buy Signal Based on 10 days Moving Average and 1.9 Standard Deviation

Source: Own processing, 2023

In this instance, the standard deviation of 1.9 shows that the present price of the security or asset is greater than 1.9 times the average variation it has experienced from its moving average over the course of the previous 10 days. This indicates that the price has gone far away from its recent average, and a reversal back towards the moving average may be overdue at this point.

Figure 13. Sell Signal Based on 10 days Moving Average and 1.9 Standard Deviation

Source: Own processing, 2023

Following an examination of the period under consideration, the results that were obtained are presented in the figure below.

Table 4. Results of Trading Strategy after Optimizing for 10 days MA and 1.9 SD

Initial Deposit	100, 000 USD	Profit Factor	1.971
Net Profit	295,895.43 USD	Average Trade	1 429.45
Total Closed Trades	207	Max Drawdown	49,183.47
Percent Profitable	34.3%	Average Number of Bars in Trades	8

Source: own processing, 2023

Figure 14. Equity Curve Of Optimizing Based on 10 days MA and 1.9 SD

Source: Own processing, 2023

Based on the result from the 10-day moving average and 1.9 standard deviations, the net profit increased from 264, 712.813 to 295,895.43 from the basic strategy and the profit factor increased from 1.927 1.971 indicating that this optimization strategy proves to be the more profitable strategy at 10 days moving average with a standard deviation of 1.9 as compared to 20 days moving average with 2 standard deviations.

Figure 15. Buy Signal Based on 50 days Moving Average and 2.1 Standard Deviation

Source: Own processing, 2023

The buy signal in the above graph is commonly understood to refer to a signal or indicator that implies it may be a good moment to purchase MSTR stock. This is because the candlestick closed above the 50-day moving average triggering a purchase condition

Figure 16. Buy Signal Based on 50 days Moving Average and 2.1 Standard Deviation

Source: Own processing, 2023

The sell signal in the above graph is commonly an indicator to change position as the trend of the stock closes below the 50-day moving average. It is a bearish indication that indicates there may be a trend reversal from an uptrend to a downtrend shortly.
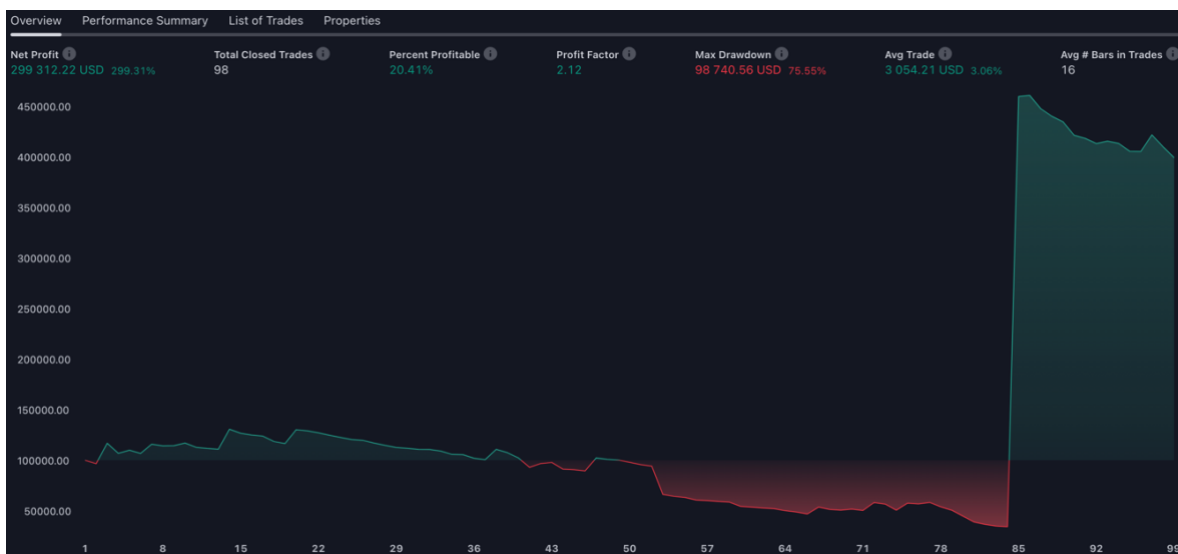
Table 5. Results of Trading Strategy after Optimizing for 50 days MA and 2.1 SD

Initial Deposit	100, 000 USD	Profit Factor	2.12
Net Profit	299 312.22 USD	Average Trade	3,054.21
Total Closed Trades	98	Max Drawdown	98,740.56
Percent Profitable	20.4%	Average Number of Bars in Trades	16

Source: own processing

Figure 17. Equity curve Of Optimizing on 50 days MA and 2.1 SD

Source: Own processing, 2023

The results from the 50-day moving average with a 2.1 standard deviation optimization strategy happen to perform better than the basic parameters. The net profit increased from 264, 712.813 from the basic strategy to 299312.22 whiles the profit factor increased from 1.927 to 2.12. The 50-day moving average can provide a gauge of the average price that is less volatile and smoother over the course of the selected period. This can assist filter out variations in the market that are occurring over shorter periods and provide a more accurate picture of the overall trend.

4.2 Trading strategy based on RSI of MicroStrategy: MSTR

Step 1: Trend definition in RSI

Generally, one may determine a trend in RSI by examining the movement of the RSI line with time. If the RSI line has been moving in an upward manner for an extended period and is located above 50, this may signal a bullish trend, which suggests that the price of the asset will most likely continue to increase. On the other hand, a bearish trend may be indicated if the RSI line is moving continuously in a downward direction and is below the level of 50. This would suggest that the price of the asset is likely to continue to fall.

On the RSI chart, repeated crossings of level 50 can be interpreted as an indication of a price pattern in which the asset is moving sideways. When the RSI line repeatedly crosses the level of 50 back and forth, it may suggest that the asset price is not trending in a clear direction and is instead moving sideways within a certain range.

In a sideways market, the price of the asset will often go up and down within a relatively small range, with little to no continuous trend in either direction. Because of this, it can be difficult for traders and investors to make trading decisions based just on the movement of the asset price. Because of this, technical indicators such as the relative strength index (RSI) can help spot prospective chances to buy or sell.

Step 2. Identifying signals to open a position in RSI

One way to identify signals for opening a position is by keeping an eye out for overbought or oversold conditions. When the Relative Strength Index (RSI) drops below 30, it may indicate that the underlying asset has been oversold and is overdue for a market correction. investors may want to consider establishing a long position at this point. When the Relative Strength Index (RSI) rises above 70, it may indicate that the asset has been overbought, and traders may consider taking a short position as a result. The period of computation for the RSI that is utilized the most frequently is 14, which indicates that the RSI is calculated using the most recent 14 candlestick sessions.

Because it strikes a healthy mix between sensitivity and reliability, the 14-period RSI is a popular choice among technical analysts. A time frame with fewer iterations, such as seven or nine, might be more responsive to changes in price but might also produce more false signals. Although a longer time frame, such as 21 or 28 days, might be more trustworthy, it might also be slower to respond to shifts in market conditions.

Figure 18. Signals to Open Position

Source: own processing, 2023

Implementation Details for RSI

- The amount of the initial deposit is 100,000 USD. the transaction cost is 0.01% of the total for one trading day.

- The order size for each long position is 100, 000 USD

- The time range chosen is from January 1, 2012, to December 31, 2021

- RSI is computed based on 14 sessions

- A buy signal is triggered when the 10 days simple moving average of the relative strength index crosses 55

- The sell signal is triggered when the 10 days simple moving average of the relative strength index closes below 55

The outcomes achieved from Relative Strength Index Strategy

The following findings were obtained through examination of the specified period, and they are shown in the table that can be seen below (Figure 3):

Table 6. Results of Trading Strategy for Relative Strength Index

Initial Deposit	100, 000 USD	Profit Factor	2.229
Net Profit	248, 279.35 USD	Average Trade	4,965.59
Total Closed Trades	50	Max Drawdown	94,715.95
Percent Profitable	28%	Average Number of Bars in Trades	20

Source: Own processing, 2023

Figure 19. Equity Curve of Relative Strength Index

Source: own processing, 2023

When compared to the basic 20-day simple moving average strategy, this trading strategy demonstrates a satisfactory profit factor from 1.927 to 2.229. The majority of the loss came from transactions in which there was a significant price movement, even though the indicator was either in the oversold or overbought zone. Also, the net profit increased from 264,712.813 to 248, 279.35.

A way to optimize for the strategy is to use a reading on the relative strength index (RSI) that is greater than 75 which shows that the stock has been overbought and which also suggests that it may be due for a correction. On the other hand, a reading of less than 25 for the RSI shows that the stock has been oversold, which suggests that it is likely overdue for a recovery. In this optimization strategy, the 10-day moving average of the relative strength index will not be used.

Table 7. Results of Trading Strategy for optimizing Relative Strength Index

Initial Deposit	100,000 USD	**Profit Factor**	5.032
Net Profit	133 840.37 USD	**Average Trade**	19 120.05
Total Closed Trades	7	**Max Drawdown**	64 735.78
Percent Profitable	71.43%	**Average Number of Bars in Trades**	210

Source: own processing, 2023

From the above optimization, the profit factor increased from 2.229 to 5.032 which signifies that this optimization strategy earned approximately 5 dollars in profit for every dollar that was lost. This is seen as a favorable profit factor and evidence that the strategy generates profits. However, the net profit for this strategy is lower compared to the initial trading strategy. This is an indication that the strategy results in a small number of trades, but the trades that it enters into are very successful

Figure 20. Equity Curve of Relative Strength Index after Optimisation

Source: own processing, 2023

5 Results and Discussion

The table shows the comparison of the Trading Strategies used in this analysis

Table 8. Comparative analysis of the trading strategies (Amount in USD)

TRADING STRATEGY		TOTAL NET PROFIT	PROFIT FACTOR	PERCENT PROFITABLE	TOTAL CLOSED TRADES
Bollinger Bands and Volume indicators	Basic Strategy	264,712.813	1.927	26.21	145
	Optimizing based on Stop loss and Take profit	18,638.98	1.104	51.43	140
	Optimizing Based on Trailing stops	25,031.87	1.137	54.41	133
	Optimization based on 10 days Moving Average and 1.9 Standard Deviation	295, 895.43	1.971	34.3	207
	Optimization based on 20 days Moving Average and 2.1 Standard Deviation	299,312.22	2.120	20.40	98
RSI	Basic Strategy	248, 279.35	2.229	28.0	50
	Optimized RSI	133, 840.37	5.032	71.43	210

Source: own processing

The initial trading strategy based on Bollinger bands and Volume offers a favorable risk-to-reward ratio. The initial capital increased by 264.71% from 2012 to 2021. If an investment had a risk-reward ratio of 264.71%, it would indicate that the possibility of profit from the investment is greater than 2.5 times the possibility of loss from the investment. Optimization was carried out in several different ways, the first of which was based on implementing stop loss and take profit. This optimization strategy resulted in a decrease in net profit from 264,712.813 to 18,638.98 which approximates about a 93% decrease in net profit. The

reason why this optimization strategy resulted in a huge decrease in profit was that stop loss was getting triggered frequently so the strategy did not have the opportunity to profit from any possible reversal of the market in their favor. Since the take profit was fixed, the strategy was not benefitting from potential further gains that the stock was experiencing.

The third optimization was done on the Bollinger bands using the trailing stops. Investors can take advantage of swings in the market with the help of a trailing stop loss, which frees them from the need to constantly monitor the market. The trader's stop order will undergo an automatic adjustment if the market price moves in a direction that is favorable to the trader's position. However, because a trailing stop is determined by the current price of a security on the market, the stop can be activated prematurely if there is an unexpected and momentary decline in the price of the security. Because of this, the trader can end up selling the investment before it has had the opportunity to rebound. The trailing stop optimization was a better improvement on the prior stop loss and take profit strategy. However, this strategy was sub-optimal as compared to the basic strategy.

According to the changing parameters optimization strategy, a change in the length of Bollinger bands from 20 days and two standard deviations to a period of 10 days and a standard deviation of 1.9 resulted in a 12% increase in the profit ratio from the base strategy. Furthermore, there was a 34.3% rise in the proportion of successful trades. This is because a moving average with a shorter period will be more sensitive to shifts in the market, while a lower standard deviation could lead to fewer false signals. The move to a period of 50 and a deviation of 2.1 for the Bollinger bands, which had previously been set at a period of 20 and a deviation of 2.0, exhibited an increase of 13% in the net profit and a reduction of profitable trades from 26.21% to 20.4%. This optimization strategy resulted in the highest value of net profit and the reason can be attributed to the fact that a longer period of the moving average helps to filter out short-term fluctuations in the price thereby giving an accurate range of accurate representation of the potential trading range of MSTR stock.

Regarding the findings based on the Relative Strength Indicator, the standard parameter values of 14 candle sessions and a 10-day moving average of the RSI resulted in a 6% decrease in profit from our basic Bollinger bands strategy with a standard parameter of 20 days moving average and 2 standard deviations. However, the percentage of profitable trades increased from 26.21% to 28%.

The optimized parameters for the RSI with values of 25 and 75 resulted in a decrease in net profit by 49% however the percentage of profitable trades rose to 71.43%. This optimization

strategy resulted in the highest number of profitable trades and also the highest number of closed trades. This is because our asset under consideration has high volatility and therefore captures the momentum pattern of the price movement of the asset.

6 Conclusion

The stock market is a highly competitive and ever-changing environment, and investors need to have the information and abilities required to make educated investing choices to succeed in this setting.

In recent years, the price of a share of MicroStrategy's stock has been very volatile, with substantial changes in both directions. Because of the company's volatile nature, there are possibilities for investors to make a profit by purchasing and selling the stock at optimal times. On the other hand, it represents a major threat to investors, who run the chance of suffering financial losses if they choose an inappropriate investment strategy.

The use of technical analysis in the financial markets has been the subject of a significant amount of research in the scholarly literature. The process of valuing assets via the examination of information produced by market activity, such as historical prices and trading volume, is known as technical analysis. The purpose of technical analysis is to recognize patterns and trends that may be used to make educated judgments on investments. There have been some studies that have shown that technical analysis is a useful technique for earning gains in the stock market and for forecasting the values of individual stocks.

Utilizing technical analysis, the purpose of this diploma thesis was to examine the feasibility of many trading methods for MicroStrategy stocks to ascertain whether or not these strategies were profitable. The research was based on three different types of technical indicators: Bollinger Bands, Volume, and Relative Strength Index. (RSI). The purpose of the research was to identify a variety of different trading methods that may be used to achieve the goal.

In the course of the research, the use of technical analysis played an essential role in determining how the price of MicroStrategy stock was likely to change soon. The use of technical indicators enables traders to make educated judgments on the best times to purchase and sell stocks, based on the results of technical analysis, which offers insight into price and market movements. The indicators that are going to be looked at for this research were selected based on how well they can forecast the direction that prices are going to go in the future.

Bollinger Bands are a specific kind of technical indicator that may be used in the process of determining how volatile the price of a stock is. The bands are made up of three lines: an

upper band, a lower band, and an intermediate band. The distance between the central band and the upper and lower bands is equal to two standard deviations. The 20-day moving average is commonly used to calculate the middle band.

In the present investigation, a trading strategy for MicroStrategy stocks was developed with the assistance of the Bollinger Bands indicator. The method called for purchasing the stock if the price dropped below the lower band and selling it whenever it rose over the upper band. In addition to that, the method included making use of the volume indication as a confirmation indicator.

The fundamental trading approach had a positive risk-to-reward ratio, but the ratio wasn't high enough to be considered adequate. As a result of this, a large number of improvements were put into place in an attempt to improve the performance of the trading method. It came out that the 50-day moving average with a 2.1 standard deviation produced the biggest profit factor, which was nearly 2 times the amount of the original investment. This was the case because it resulted in the best return on investment. A lucrative trading strategy is denoted by a value of the profit factor that is larger than 1, and the profit factor is a measure of how profitable a trading strategy is.

The trailing stop optimization method, on the other hand, was the one that ended up giving us the greatest proportion of winning trades, which was over 54%. Setting a stop-loss order at a price that is a particular percentage below the stock's current price is an essential part of the trailing stop technique. This percentage is typically determined by looking at how volatile the stock is.
The Relative Strength Index (RSI) is a form of technical indicator that determines the degree to which the price movement of an asset is strong. It does this by comparing the current price to a previous price. The relative strength index (RSI) is arrived at by analyzing a security's performance over a certain amount of time and contrasting the normal gains and losses with those results. The Relative Strength Index (RSI) is shown on a scale that runs from 0 to 100. When the Relative Strength Index (RSI) drops below 30, the market is deemed to be in an oversold condition, and when it climbs over 70, the market is considered to be in an overbought condition.

In this particular investigation, the Relative Strength Index (RSI) was used to formulate a trading strategy for MicroStrategy companies. In comparison to the basic strategy of the Bollinger bands, which had a greater proportion of winning trades but a smaller number of closed deals, the basic strategy of the RSI, which used the 10-day moving average of the RSI, resulted in a lower net profit. This approach produced the maximum number of closed deals, profit factor, and percentage of profitable trades when optimized with RSI values of 75 and 25. It also produced the highest proportion of profitable trades. However, as compared to the fundamental approach of the Bollinger bands, the overall net profit was much smaller.

The application of technical analysis in the assessment of trading strategies for MicroStrategy stocks has proven to be beneficial in forecasting future price changes. All of the indicators that were taken into account, including Bollinger Bands, Volume, and the Relative Strength Index, were successful in determining profitable trading strategies.

According to the findings of the study, purchasing MicroStrategy stock is a smart financial move that is certain to generate a satisfactory rate of return on investment. The return on investment was approximately 18% for the transaction, which resulted in a net profit that was approximately 18000 USD.

The highest net profit value from one of the optimizations of the parameters of the Bollinger bands from the 20-day moving average to 50 day moving average with a standard deviation of 2.1 resulted in a 300% return on the initial startup capital investment. These results evidence the fact that investing in MicroStrategy stock is a sound investment and will return a decent amount on investment. Furthermore, it can also be observed that since the adoption of the bitcoin standard by MicroStrategy, MicroStrategy's stock price increased significantly allowing investors to benefit from the price increase. Moreover, a critical observation of the price movement of MicroStrategy stock from the period of adopting the bitcoin standard has resulted in a massive increase in the net profit for the trading strategies adopted for this analysis.

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