

13 Asset Investing and Trading

Learning Objectives

After reading this chapter, you should be able to:

- LO 13.1** Develop the skills to evaluate a company's financial health and intrinsic value.
- LO 13.2** Learn the difference between fundamental and nonfundamental analyses.
- LO 13.3** Understand the risks and potential reward in AI stocks and cryptoassets.
- LO 13.4** Gain proficiency in using technical analysis tools to identify potential buy and sell signals.
- LO 13.5** Learn to analyze market trends to make informed investment decisions.
- LO 13.6** Learn robust trading strategies in cryptocurrency asset class.
- LO 13.7** Determine the characteristics of AI stock and ETF analysis.

In the rapidly evolving landscape of fintech, making informed investment decisions and developing robust trading strategies are essential skills for any investor. This chapter presents the fundamental concepts and advanced techniques necessary to navigate the complexities of modern financial markets. By the end of this chapter, you will have a comprehensive understanding of market analysis, risk management, technical and fundamental analysis, and the unique challenges and opportunities presented by cryptocurrency trading.

Investing always involves risk but managing that risk is crucial to preserving capital and ensuring long-term success. You will learn essential **risk management** strategies, such as setting stop-loss orders, using hedging instruments, and diversifying investments. These strategies will help you tailor your risk management approach to your specific financial goals and circumstances, protecting your investments from market volatility and unforeseen events.

Fundamental analysis is essential for assessing the financial health and intrinsic value of a company. You will learn to analyze financial statements, use financial ratios, and apply valuation models, such as the price-to-earnings (P/E) ratio and discounted cash flow (DCF) analysis, to determine whether a company's stock is overvalued or undervalued. This skill is crucial for making informed investment decisions based on a company's fundamentals.

Technical analysis involves studying past market data to forecast future price movements. You will be introduced to key technical analysis tools and indicators, such as moving averages, relative strength index (RSI), and Bollinger Bands. These tools help to identify potential entry (buy) and exit (sell) points in the market or a specific asset, like a stock or cryptocurrency. Proficiency in technical analysis can significantly improve your trading outcomes.

Algorithmic trading uses computer algorithms to execute trades based on predefined criteria. You will be introduced to the basics of algorithmic trading, learning to develop and implement your own automated trading strategies.

risk management

A process of determining the risks that exist in an investment and then mitigating those risks.

fundamental analysis

Evaluating a stock's intrinsic value by examining related economic, financial, and other qualitative and quantitative factors.

technical analysis

The study of statistical trends from trading activity, such as price movement and volume, to predict future price movements.

algorithmic trading

A method of executing buy and sell orders using automated pre-programmed trading instructions.

intrinsic value

The perceived and/or computed true value of an investment asset.

Leveraging programming languages and trading platforms will enable you to execute trades efficiently and effectively, optimizing trading performance and reducing human error.

Cryptocurrencies present unique challenges and opportunities for investors. This chapter covers the fundamentals of cryptocurrency trading, including how to analyze market sentiment, use technical and fundamental analysis for digital assets, and implement risk management strategies tailored to the high volatility of the crypto market. Understanding different trading strategies, such as holding, day trading, and arbitrage, will help to capitalize on the dynamic nature of cryptocurrencies.

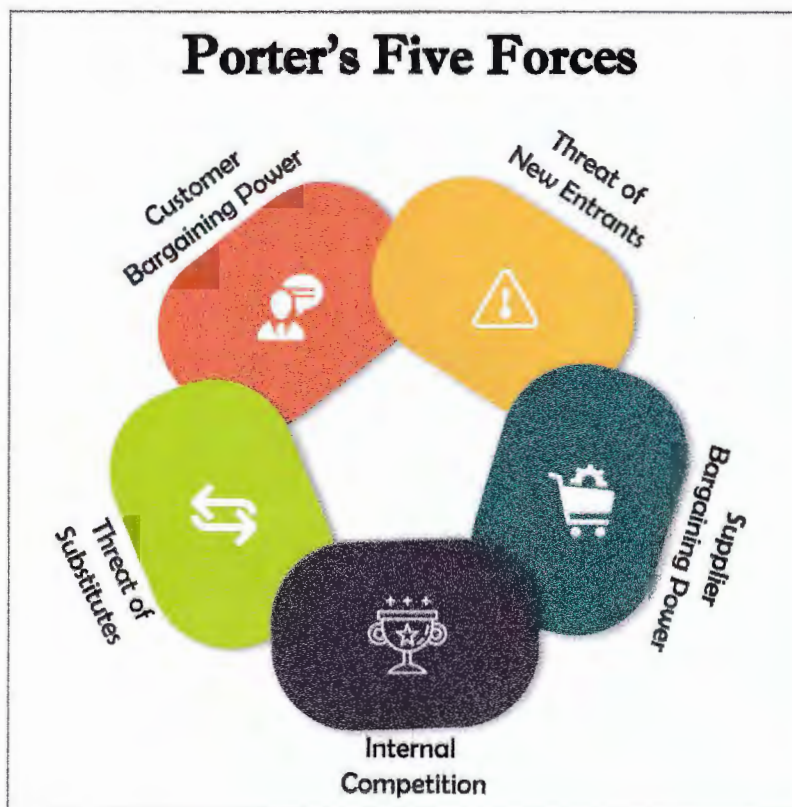
This chapter provides a comprehensive overview of the essential skills and strategies needed to make informed investment decisions and develop robust trading strategies in today's financial markets. By mastering these concepts, you will be well equipped to navigate the complexities of investing and trading, whether in traditional asset classes or emerging fields like cryptocurrency.

13.1 Fundamental Analysis: An Overview

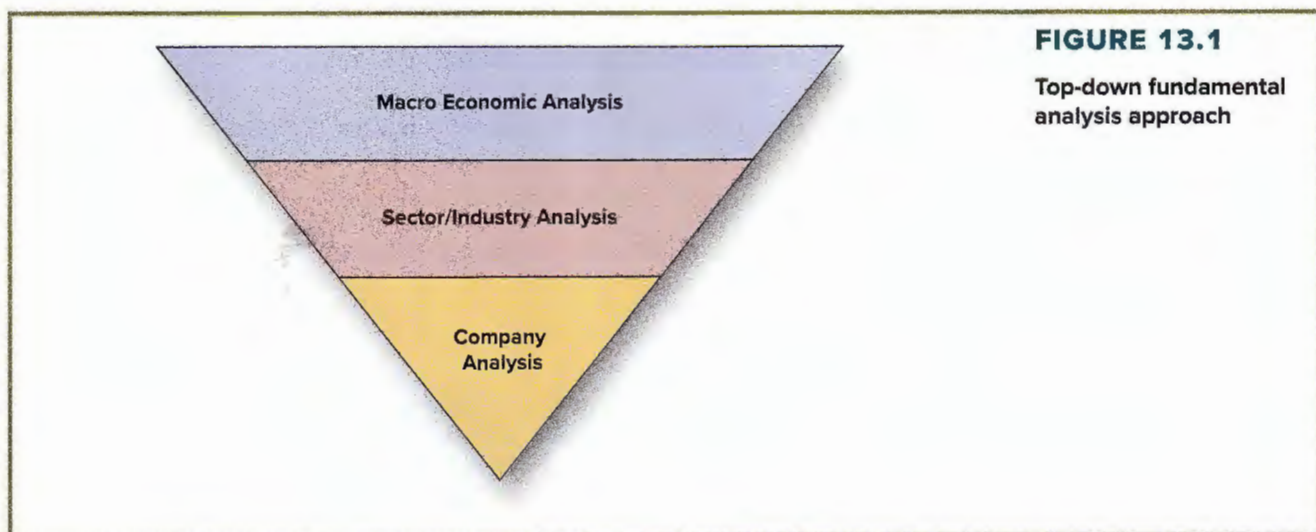
Fundamental analysis is a method used to evaluate the **intrinsic value** of a security by examining related economic, financial, and other qualitative and quantitative factors. Unlike technical analysis, which focuses on price movement and volume, fundamental analysis involves a deeper dive into the company's financial health, its management, industry conditions, and broader economic factors. This analysis is crucial for investors who seek to understand whether a stock's price is overvalued or undervalued and to make long-term investment decisions.

13.1.1 Key Components of Fundamental Analysis

Fundamental analysis is typically conducted from a macroeconomic perspective to a microeconomic perspective. In other words, analysis starts with the economy and ends with the firm. This top-down approach is depicted in Figure 13.1. Analysts analyze the



Skyline Graphics/Shutterstock



economy to determine which sectors and industries are likely to perform well. A sector/industry analysis helps to understand the dynamics of the industry and highlight which firms may perform the best. A company analysis helps to determine whether the investor should buy it.

ECONOMIC ANALYSIS Fundamental analysis begins with an examination of the broader economy. This includes studying economic indicators such as GDP growth rates, inflation, interest rates, and employment figures. The state of the economy can significantly impact a company's performance. For instance, during a recession, even fundamentally strong companies might experience a downturn in their stock prices due to reduced consumer spending.

INDUSTRY ANALYSIS Once the underlying economic landscape is known, understanding which industries will benefit is crucial. This involves analyzing industry trends, the competitive landscape, the regulatory environment, and the industry life cycle. An industry that is growing rapidly may offer better investment opportunities than a stagnant or declining industry. Tools such as Porter's five forces can be useful in industry analysis. Michael Porter devised a framework to evaluate the competitive dynamics of an industry. His five key elements are the risk posed by new entrants, the influence wielded by suppliers, the power of buyers, the threat from substitute products or services, and the intensity of competition among existing players.

COMPANY ANALYSIS The core of fundamental analysis involves a detailed examination of the company's financial statements, including the income statement, balance sheet, and cash flow statement. Key metrics and ratios derive from these financial statements and are used to gauge the company's profitability, liquidity, solvency, and operational efficiency.

13.1.2 Company Metrics and Ratios

Company financial ratios are ratios of accounting statement values and sometimes the stock price. Their purpose is to scale important information, like earnings, to the size of the firm. Doing so makes it easier to interpret those values and compare them to other firms. These are the most commonly used financial ratios.

The following metrics will be computed using the firm NVIDIA Corporation (NVDA). NVIDIA is a leading American technology company specializing in AI computing, graphics processing units (GPUs), and high-performance systems for industries ranging

from gaming and data centers to autonomous vehicles and health care. Table 13.1 shows NVIDIA's abbreviated Income Statement and Balance Sheet.

price-to-earnings (P/E) ratio

A popular ratio used for assessing relative value of a company.

PRICE-TO-EARNINGS RATIO The **price-to-earnings (P/E) ratio** is one of the most widely used valuation metrics in fundamental analysis. It measures a company's current share price relative to its per-share earnings. The formula is

$$\text{P/E ratio} = \text{Market price per share} \div \text{Earnings per share (EPS)} \quad (13.1)$$

TABLE 13.1 | NVIDIA's Financial Statements

Panel A Income Statement (numbers in thousands)

	January 31, 2025	January 31, 2024
Total revenue	\$ 130,497,000,000	\$ 60,922,000,000
Cost of revenue	32,639,000,000	16,621,000,000
Gross profit	\$ 97,858,000,000	\$ 44,301,000,000
Operating expense		
General and administration	3,491,000,000	2,654,000,000
Research and development	12,914,000,000	8,675,000,000
Total operating expense	16,405,000,000	11,329,000,000
Operating income	\$ 81,453,000,000	\$ 32,972,000,000
Other income or expenses		
Net nonoperating interest income	1,539,000,000	609,000,000
Other income	1,034,000,000	237,000,000
Earnings before taxes	\$ 84,026,000,000	\$ 33,818,000,000
Taxes	11,146,000,000	4,058,000,000
Net income	\$ 72,880,000,000	\$ 29,760,000,000
EPS	2.97	1.21
Basic average shares	24,555,000,000	24,690,000,000
Price per share	\$ 154.13	\$ 126.05

Panel B Balance Sheet (numbers in thousands)

	January 31, 2025	January 31, 2024		January 31, 2025	January 31, 2024
Assets			Liabilities		
Current assets			Current liabilities		
Cash and equivalents	\$ 8,589,000,000	\$ 7,280,000,000	Payables	\$ 7,191,000,000	\$ 2,995,000,000
Short-term investments	34,621,000,000	18,704,000,000	Accrued expenses	8,130,000,000	4,780,000,000
Accounts receivable	23,065,000,000	9,999,000,000	Current debt		1,250,000,000
Inventory	10,080,000,000	5,282,000,000	Other current liabilities	2,726,000,000	1,606,000,000
Other current assets	3,771,000,000	3,080,000,000	Total current liabilities	\$ 18,047,000,000	\$ 10,631,000,000
Total current assets	\$ 80,126,000,000	\$ 44,345,000,000			
			Long-term liabilities		
Property, plant, and equipment	8,076,000,000	5,260,000,000	Long-term debt	8,463,000,000	8,459,000,000
Goodwill	5,995,000,000	5,542,000,000	Long-term capital lease	1,519,000,000	1,119,000,000
Financial assets	3,387,000,000	1,321,000,000	Other liabilities	4,245,000,000	2,541,000,000
Other long-term assets	14,017,000,000	9,260,000,000	Total long-term liabilities	\$ 14,227,000,000	\$ 12,119,000,000
Total long-term assets	\$ 31,475,000,000	\$ 21,383,000,000	Total liabilities	\$ 32,274,000,000	\$ 22,750,000,000
			Stockholders' equity		
Total assets	\$ 111,601,000,000	\$ 65,728,000,000	Capital stock	48,000,000	50,000,000
			Additional paid in capital	11,241,000,000	13,111,000,000
			Retained earnings	68,038,000,000	29,817,000,000
			Stockholders' equity	\$ 79,327,000,000	\$ 42,978,000,000
			Total liabilities and equity	\$ 111,601,000,000	\$ 65,728,000,000

TABLE 13.2 | Key NVIDIA Metrics and Ratios

	January 31, 2025	January 31, 2024
P/E ratio	51.9	101.7
REG ratio	1.2	2.0
Return on equity (ROE)	91.9%	69.2%
Return on assets (ROA)	65.3%	45.3%
Net profit margin	55.8%	48.8%
Current ratio	4.44	4.17
Debt-to-equity ratio	0.41	0.53

A high P/E ratio might indicate that a stock is overvalued, or investors are expecting high growth rates in the future. Conversely, a low P/E ratio might suggest that a stock is undervalued or that the company is experiencing difficulties. The P/E ratio for NVIDIA is quite high, as shown in Table 13.2. However, it did decline from 101.7 in 2024 to 51.9 in 2025.

PEG RATIO The P/E ratio suggests whether a firm is a growth or value firm. The **PEG ratio** adds growth to the measure. It is the P/E ratio divided by the expected earnings growth rate of the firm. A lower PEG ratio indicates a better value for the expected growth rate. Consider that NVIDIA was expected to grow by 43.88 percent and 50 percent, respectively, in 2025 and 2024. Its PEG ratio improved from 2.0 in 2024 to 1.2 in 2025.

PEG ratio

The price/earnings-to-growth ratio measures how expensive a stock is relative to its growth rate.

RETURN ON EQUITY RATIO The **return on equity (ROE)** ratio measures the firm's profitability on its shareholders' capital. The higher the ROE, the more profitable the firm.

return on equity (ROE)

ROE measures the profitability of a business in relation to its shareholders' equity.

$$\text{ROE} = \text{Net income} \div \text{Shareholder's equity} \quad (13.2)$$

Some people like a similar ratio, **return on assets (ROA)**, which is net income divided by total assets of the firm instead of equity. For NVIDIA, these ratios are quite high. For 2025, its ROE and ROA were 91.9 and 65.3 percent, respectively.

return on assets (ROA)

ROA measures the profitability of a business in relation to its total assets.

NET PROFIT MARGIN **Net profit margin** is the proportion of sales that contributes to the net income of the firm. It is considered the percentage of each dollar of revenue that is profit. NVIDIA's net profit margin improved from 48.8 to 55.8 percent, which are both very high.

net profit margin

Financial ratio that measures a company's profit as a percentage of its revenue.

$$\text{Net profit margin} = (\text{Revenue} - \text{costs}) \div \text{Revenue} \quad (13.3)$$

CURRENT RATIO The **current ratio** measures the company's ability to meet its short-term obligations with its short-term assets.

current ratio

Measures whether a firm has enough resources to meet its short-term obligations.

$$\text{Current ratio} = \text{Current assets} \div \text{Current liabilities} \quad (13.4)$$

A higher current ratio indicates greater ability to pay its bills with the current assets (including cash) on hand. NVIDIA's current ratio (over 4.0) is very high and indicates a high ability to pay its debts in the short term.

DEBT-TO-EQUITY RATIO The **debt-to-equity ratio** measures the proportion of borrowed capital to capital contributed by shareholders.

debt-to-equity ratio

Shows the firm's financial leverage through the proportion of a company's debt compared to its assets.

$$\text{Debt-to-equity ratio} = \text{Total liabilities} \div \text{Shareholder equity} \quad (13.5)$$

A higher value indicates that the firm is using more financial leverage. Higher financial leverage entails more risk when business is poor and more profits when business is good. NVIDIA does not use much financial leverage, thus its debt-to-equity ratio was 0.41 and 0.53 in 2025 and 2024, respectively.

discounted cash flow (DCF)

The value of an investment based on its expected future cash flows.

weighted average cost of capital (WACC)

A representation of a firm's blended cost of capital across all capital sources, including common shares, preferred shares, and debt.

technical indicators

Mathematical calculations based on the price and/or volume of a security to predict the future price trend.

sentiment indices

Graphical or numerical indicators designed to show how a population feels about the market or economy.

put/call ratio

This ratio measures the proportion between all put options and all call options purchased on any given day to determine investor sentiment.

DISCOUNTED CASH FLOW ANALYSIS Discounted cash flow (DCF) analysis is a method used to estimate the value of an investment based on its expected future cash flows. The future cash flows are discounted back to their present value using a discount rate, often the company's **weighted average cost of capital (WACC)**. The formula for DCF is

$$DCF = \sum \frac{Cash\ flow_t}{(1 + r)^t} \quad (13.6)$$

Cash flow_t is the per share cash flow at time *t* and *r* is the discount rate. The DCF analysis provides a per share intrinsic valuation of a company by focusing on the fundamental aspects of its cash generation capabilities. This valuation can be compared to the current stock price to determine whether it is undervalued or overvalued. It is particularly useful for valuing companies with stable and predictable cash flows.

Fundamental analysis is most used to analyze companies. However, it is less useful in analyzing assets that do not have traditional financial statements, like cryptocurrencies. Thus, other tools might be used, like technical analysis, sentiment analysis, or quantitative analysis.

13.1.3 Differences Between Fundamental and Non-Fundamental Analyses

Technical analysis is the most common form of non-fundamental analysis. Its underlying objective is to determine the supply and demand (and associated trends) of an asset. To do that, it focuses on historical price and volume data to predict future price movements. Technical analysts use charts and **technical indicators** such as moving averages, RSI, and Bollinger Bands to identify trends and trading signals. These tools will be described later in this chapter. Unlike fundamental analysis, technical analysis does not consider the intrinsic value of a security.

Sentiment analysis involves gauging the mood of investors through various means such as news articles, social media, and market surveys. It is based on the idea that when investors are optimistic (pessimistic) about an asset, they will buy (sell) it and drive up (down) prices. Thus, market sentiment can influence price movements. Tools such as **sentiment indices** and the **put/call ratio** are commonly used in this type of analysis.

Quantitative analysis uses mathematical and statistical modeling to evaluate investments. It involves the use of complex algorithms and computer models to identify patterns and predict future performance. Quantitative analysis can incorporate elements of both fundamental and technical analysis but often focuses on large data sets and automated trading strategies. These methods are associated with machine learning and artificial intelligence, as detailed in the second half of this textbook.

13.1.4 Advantages and Limitations of Fundamental Analysis

Advantages of fundamental analysis include its *long-term perspective*. It is best suited for long-term investors. It provides a comprehensive understanding of a company's intrinsic value, which helps in making informed investment decisions. In addition, fundamental analysis requires an *in-depth understanding* of the firm. By analyzing a company's financial health, industry position, and economic environment, investors gain a complete understanding of the factors that drive its performance. Lastly, the process *identifies undervalued stocks*. Fundamental analysis can help identify undervalued stocks that have the potential for substantial long-term gains and identify overvalued stocks whose price might decline or languish.

There are also limitations of fundamental analysis. For example, it is *time-consuming*. Conducting a thorough fundamental analysis requires significant time and effort, as it involves a detailed examination of various factors. It also involves some *subjectivity*.

Some aspects of fundamental analysis, such as evaluating management quality and future growth prospects, can be subjective and open to interpretation. Lastly, *short-term market price movements* may not always reflect the intrinsic value determined by fundamental analysis. In the short run, a stock's price can become more undervalued before moving toward intrinsic value. These short-term changes are often due to market sentiment and other external factors.

13.1.5 Integrating Fundamental and Non-Fundamental Analyses

While fundamental analysis provides a solid foundation for investment decisions, integrating non-fundamental analyses can enhance investment strategies. For instance, some investors use fundamental analysis to determine which stocks to buy and technical analysis to determine optimal entry and exit points for purchase and sale. Similarly, incorporating sentiment analysis can provide insights into market psychology and potential price movements.

In conclusion, fundamental analysis remains a cornerstone of investment strategy, offering insights into a company's intrinsic value through the examination of economic, industry, and company-specific factors. Tools such as the financial ratios and DCF analysis are essential for evaluating a company's financial health and valuation. While fundamental analysis focuses on long-term value, non-fundamental analyses like technical, sentiment, and quantitative analysis offer additional perspectives that can help investors navigate the complexities of financial markets. By understanding and integrating these various approaches, investors can develop more robust and informed investment strategies, ultimately enhancing their ability to achieve long-term financial success.

FINTECH IN THE WORLD

The Spectacular Rise of NVIDIA

Just a few years ago, NVIDIA was not likely a household name for investors. Yet, by 2023, it was one of the top-tier groups of tech stocks known as the Magnificent Seven, which includes Alphabet, Amazon, Apple, Meta, Microsoft, NVIDIA, and Tesla. NVIDIA was up 239 percent in 2023, and the Magnificent Seven company stocks were up an average of 111 percent in 2023.

Why did this growth occur so quickly? NVIDIA is one of the world's largest producers of GPUs and gaming computer chips. GPUs are computer chips that use math operations to produce visuals and images. NVIDIA's advanced chips process the massive amounts of data needed to train generative AI programs, such as ChatGPT and Gemini. Companies like Apple and Microsoft are spending money on AI and need NVIDIA's chips to run the technology. NVIDIA dominated this chip market before the demand for AI exploded and has only grown larger to meet this increasing demand.

NVIDIA's gaming chips are also in high demand. Video games require ever more capable cards to run the high-resolution images, especially as more games move to the cloud. NVIDIA's gaming GPUs are driving gaming at higher resolution and quicker speeds.

NVIDIA's market capitalization (defined as shares outstanding times stock price) has rapidly grown as well. In the middle of 2023, NVIDIA's capitalization passed the \$1 trillion mark and was more valuable than Amazon and Alphabet. Just nine months later, in February 2024, its market capitalization increased to \$2 trillion. In only three more months it reached \$3 trillion. NVIDIA is now the third-largest U.S. company based on market capitalization behind Apple and Microsoft.

13.2 Key Differences in Cryptocurrency and AI Company Investing

Cryptocurrency and artificial intelligence (AI) companies represent two distinct asset classes that have garnered significant attention in the financial world. Both offer unique investment opportunities and are reshaping traditional investment strategies. In this exploration, we turn to the key differences between these asset classes, analyzing their characteristics, valuation methods, risks, and potential returns.

13.2.1 Overview of Cryptocurrency as an Asset Class

Cryptocurrency, often referred to as digital or virtual currency, operates independently of a central bank. It uses blockchain technology to facilitate secure and decentralized transactions. The most well-known cryptocurrency is bitcoin, but there are thousands of others, including ether, Ripple, and Litecoin. In assessing a cryptocurrency, it is important to understand the characteristics that make it different from other investment assets. For example, cryptocurrencies operate on decentralized networks, eliminating the need for intermediaries like banks. Also, as shown in previous chapters, cryptocurrency markets are highly volatile, experiencing rapid price fluctuations due to factors such as market sentiment, regulatory changes, and technological developments. Some of this volatility stems from the coins' limited supply, leading to scarcity and potential value appreciation. Lastly, cryptocurrencies have tremendous global accessibility as they can be traded 24/7 across the globe.

VALUATION METHODS

- *Market sentiment.* Cryptocurrency prices are influenced by market sentiment, social media trends, and investor speculation.
- *Fundamental analysis.* Some investors analyze the underlying technology, adoption rates, and network activity to assess the long-term value proposition of cryptocurrencies.
- *Technical analysis.* This is one of the most popular forms of analysis. Traders use chart patterns, trading volumes, and other technical indicators to make short-term trading decisions.

RISKS The cryptocurrency markets are subject to an intense and critical regulatory environment, along with legal uncertainties in many jurisdictions. The crypto industry tends to move much faster than regulators. When regulators finally provide rules and policy guidance, crypto entrepreneurs often have to backtrack and adapt.

There are security concerns in cryptocurrency wallets and markets. Many hacking incidents, exchange breaches, and thefts have occurred, which pose significant risks to investors' holdings. In addition, these markets have been susceptible to manipulation. The lack of regulation and oversight fosters manipulation and fraudulent activities.

POTENTIAL RETURNS At this stage in their life cycle, cryptocurrency assets are a very speculative investment. That is, many seek to profit from short-term price movements rather than from long-term value appreciation. As shown in Chapters 4 and 5, bitcoin and ether have achieved very high average monthly returns that are much higher than stock market returns. But while cryptocurrencies offer the potential for high returns, they also come with high volatility, leading to significant price swings in short periods. Thus, the price at which an investor buys a cryptoasset is more important than it is for other asset classes.

13.2.2 Overview of AI Companies as an Asset Class

AI companies use artificial intelligence technologies such as machine learning, natural language processing, and computer vision to develop innovative products and services. These companies operate across various sectors, including health care, finance, e-commerce, and cybersecurity. They are characterized by innovation through leveraging cutting-edge technologies to solve complex problems and enhance efficiency and productivity. AI has diverse applications across industries, including data analysis, automation, predictive modeling, and personalized recommendations. These applications tend to offer scalability, allowing companies to process large volumes of data and adapt to changing business requirements. This process creates valuable intellectual property rights related to their algorithms, software, and proprietary data sets that need to be protected.

VALUATION METHODS

- *Fundamental analysis.* Investors assess AI companies based on their growth potential, market opportunity, and competitive positioning within the industry. Analysts evaluate the revenue growth rates, recurring revenue streams, and customer acquisition metrics to gauge the company's financial performance. Future growth is often dependent on strategic partnerships with industry leaders, research institutions, and government agencies.
- *Technical analysis.* Many AI companies are still in their early business stage and may not be earning profits. Thus, tools like cash flow analysis are problematic. Thus, technical analysis is also popular because the stock price and trading volume is readily available for public firms.
- *Market sentiment.* AI companies have also been greatly influenced by market sentiment as investors experience the fear of missing out (FOMO) in the next evolution of business.

RISKS As technology evolves and the need for data exponentially increases, AI companies face challenges related to data privacy, model interpretability, and cybersecurity vulnerabilities. In addition, the AI industry is highly competitive, with numerous start-ups and established players vying for market share and talent. Much of this data includes personal information, and thus AI technologies are subject to regulatory oversight, particularly in areas such as data protection and ethical use.

POTENTIAL RETURNS AI companies offer the potential for long-term growth as they capitalize on emerging trends such as automation, digital transformation, and the Internet of Things (IoT). Investors may assign a premium to companies with disruptive technologies and first-mover advantages in rapidly evolving markets. Note that large established firms often acquire smaller firms and start-ups that show innovative technology or business solutions to gain access to talent and intellectual property. These smaller firms get bought out at a premium, leading to significant returns for investors. Consider the powerhouse AI company NVIDIA Corporation (NVDA). It has become the third-largest company in the S&P 500 Index and increased nearly tenfold in the past two years. Along the way, it has acquired many other smaller firms to add to its technological advantages.

In conclusion, cryptocurrency and AI companies represent two distinct asset classes with unique characteristics, valuation methods, risks, and potential returns. While cryptocurrency offers speculative investment opportunities with high volatility, AI companies present long-term growth prospects driven by technological innovation and industry-specific applications. Investors should carefully assess their risk tolerance, investment objectives, and market dynamics when considering exposure to these asset classes.

13.3 Technical Analysis for Investing and Trading Cryptocurrencies

This section introduces essential technical analysis tools. Entire books are available detailing all of the chart patterns and technical indicators. The focus here will be on the most common ones applicable to trading strategies. It is crucial to differentiate between investing, which is typically long term, and trading, which is short term. The trading strategies discussed here are more suited to short-term investments and trading, making them particularly relevant for cryptocurrency but also applicable to traditional equity assets. In this context, a cryptocurrency coin can be likened to a share of stock.

Technical analysis has its own vocabulary, as will be highlighted later in this chapter. Two key trading terms are **long position** and **short position**. When a trader buys a cryptocurrency asset or shares, it is called a long position. The trader makes money when its price rises and loses money when its price falls. A short position makes money when the price falls and loses money when its price rises. How can you enter a short position with stock? Essentially, you borrow stock from the stockbroker and sell it. You get cash from selling the stock. When the price declines, you can buy it back for less money than you sold it for and keep the difference. You can do the same with a cryptoasset. The investor receives cash from the short sale of coins, but behind the scenes the trader's brokerage company is temporarily lending it to the trader. The trader must eventually buy back the coin and return it to the brokerage to close out the short position. Note that both a long and short position makes money from buying low and selling high. They just do it in a different order.

long position

Investment position in which the investor owns the asset and obtains value when its price increases.

short position

An investment position created when a trader sells a security first with the intention of repurchasing it or covering it later at a lower price.

candlestick chart

A type of price chart used in technical analysis that displays the high, low, open, and closing prices of a security for a specific period.

support and resistance levels

Price levels where a stock frequently reverses direction, used to identify potential entry and exit points.

breakout

Occurs when an asset's price crosses over a resistance level or falls below a support level.

13.3.1 Price Action

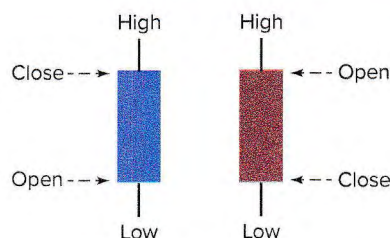
The next term to learn is the **candlestick chart** and line chart. Candlestick charting was first used in Japan in the 1750s to analyze the link between the price of rice via its supply and demand. Each candle captured the price movement during a time interval for the rice market. The charting tool visually represents the size of price moves with different colors. Traders consider the candlesticks to project the short-term direction of the price and use this signal for trading decisions based on regularly appearing patterns.

Figure 13.2 shows blue and red candlesticks. The blue candle is when the close price is higher than the open price, which indicates the price rose during the period. The red candlestick is when the close price is lower than the open price, indicating a price decline. A candlestick has two key characteristics; the high and low during the given time period are represented by the wicks of the candles, and the close and open make up the body of the candle. These candlestick charts are useful for filtering out market noise.

The next set of terms are **support**, **resistance**, and **breakout**. Figure 13.3 shows a support line, which is the price level where traders or investors consider the stock/coin to be at a discount and buy in at that level. In other words, there is demand for the asset at that price. Those traders buy it, which pushes the price up. When determining a support

FIGURE 13.2

Candlesticks



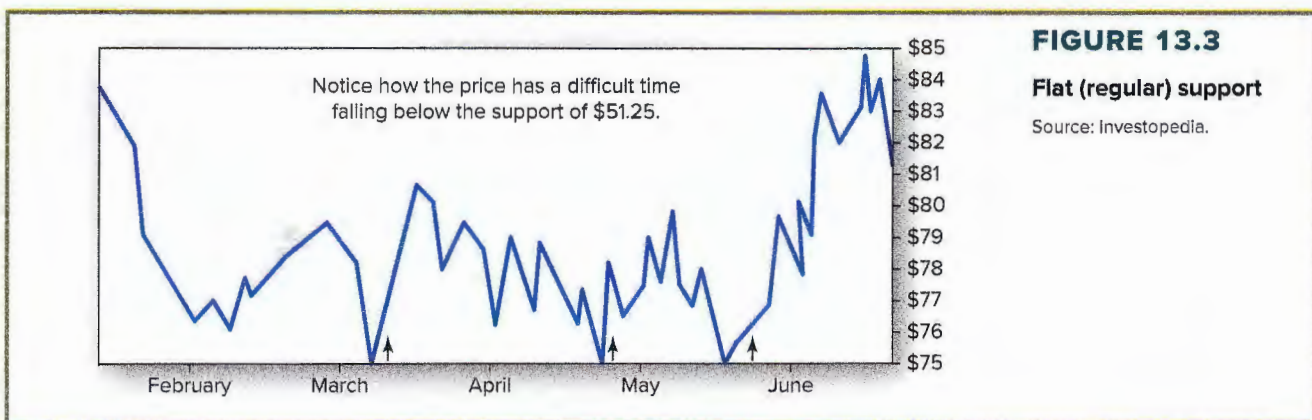


FIGURE 13.3

Flat (regular) support

Source: Investopedia.

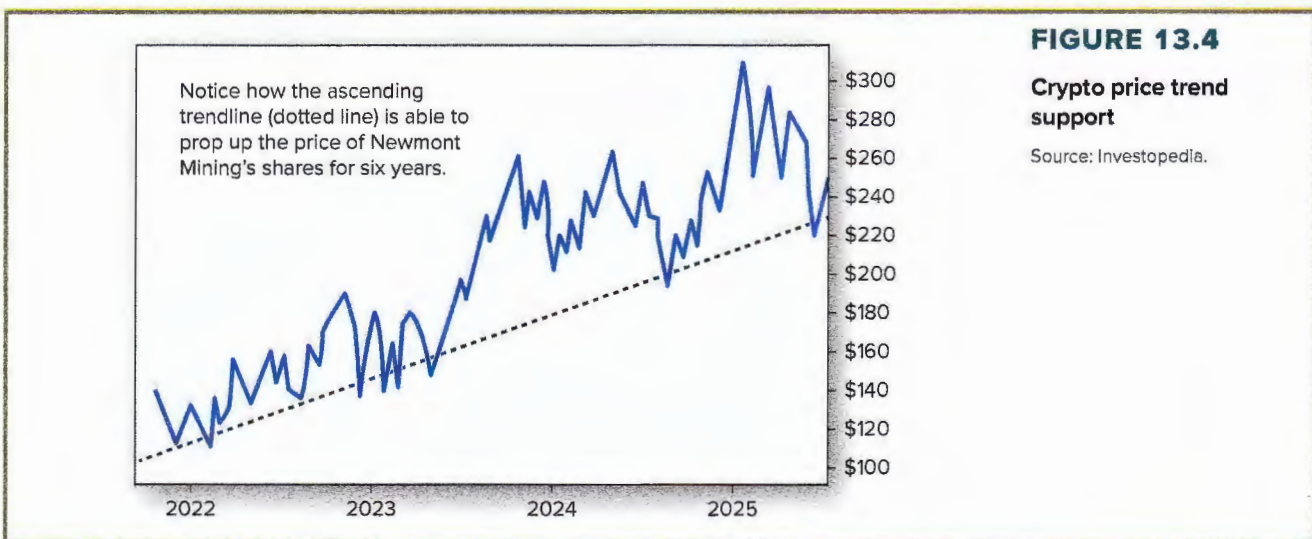


FIGURE 13.4

Crypto price trend support

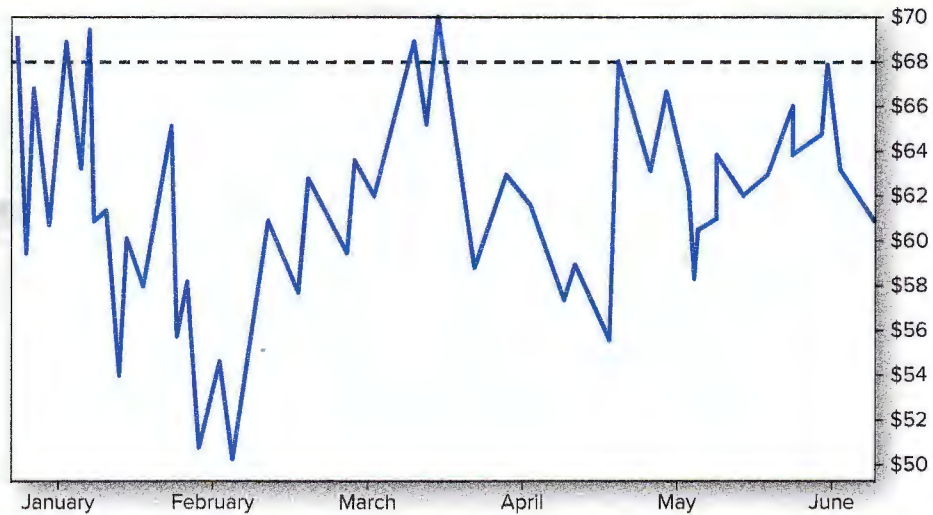
Source: Investopedia.

level, a trader must observe at least three or more points where the price bounces. The time frame is critical because a longer time frame provides more reliable trend information. Therefore, the longer the time frame, the higher the significance of the support level. Figure 13.3 shows the support line as horizontal, but it can slant up or down as shown in Figure 13.4, which shows an increasing trend in the market.

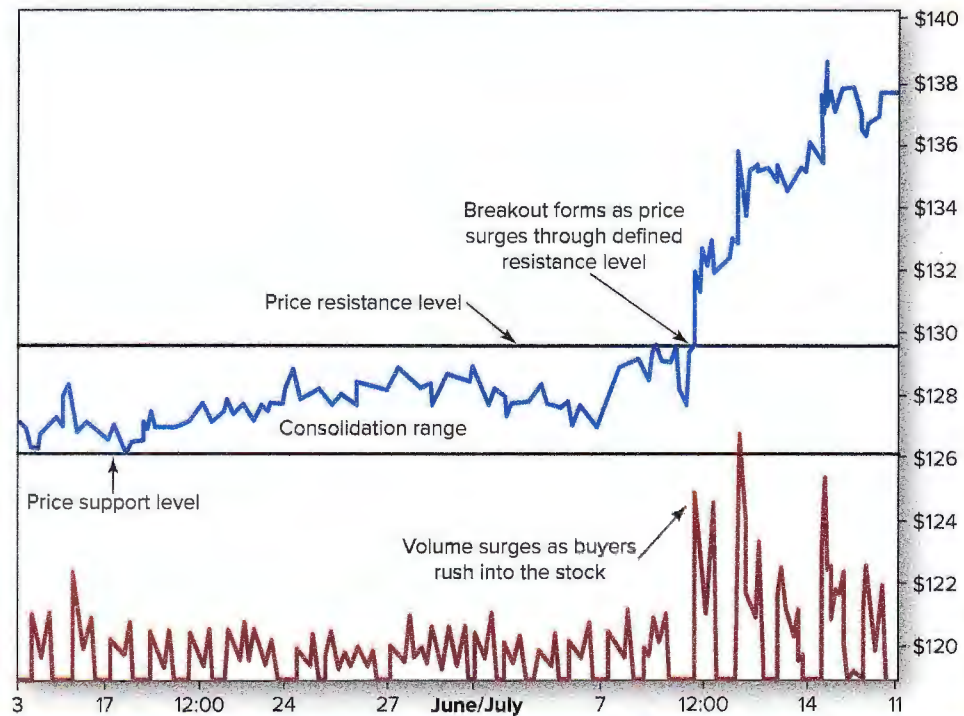
At these price support levels, the cryptocurrency/stock or current market sentiment is thought to be bullish, so investors should not sell or short at these levels. Based on the support levels, a trader can decide on the entry/exit (i.e., long/short) decision. With such a bullish trend, a trader would not want to take profit or take a short position at a support line level.

Resistance levels are the opposite of support levels, as illustrated in Figure 13.5. The resistance level represents the price at which there is supply for the asset. That is, investors and traders are looking to sell. At resistance levels, a long trader will be looking to take profits. Some traders may even look to take a short position. Both support and resistance lines are very important in trading since they help the trader to better define and filter entry and exit decisions.

A breakout happens when a support and/or resistance price level gets broken. Refer to Figure 13.6 for an illustration of a crypto/stock price breakout. In these circumstances, when the price breaks upward through a resistance line, then that former upper resistance line becomes the new lower support/resistance level. So, when the resistance price level becomes broken to the upside, the prior resistance price level is considered the new support level. Conversely, if a support level gets broken to the downside, the prior support level becomes the new resistance line.

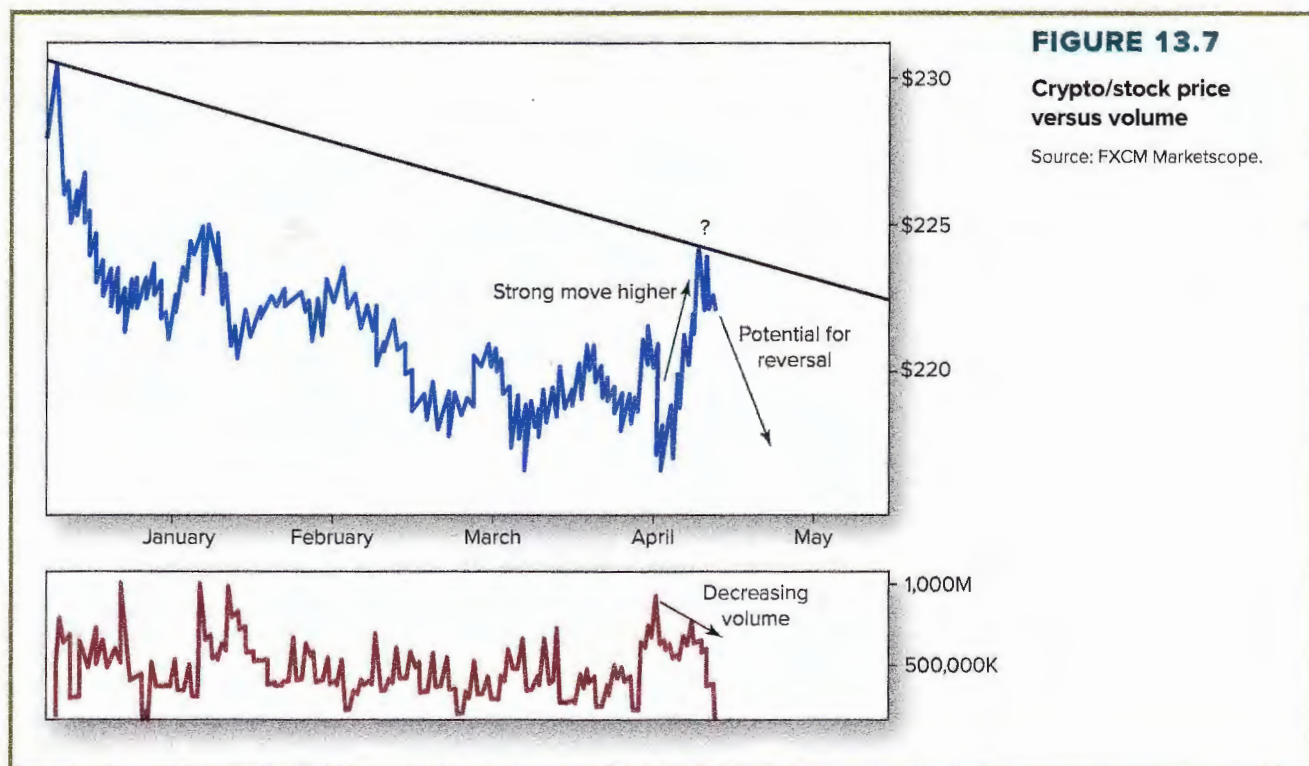
FIGURE 13.5**Crypto/stock price
resistance level****FIGURE 13.6****Crypto/stock price
breakout**

Source: InvestorsLive, LLC.



13.3.2 Volume and Why It Matters

The trading volume is the number of shares of a security that are traded for a given period. Most investors and traders do not make trading decisions based off volume data by itself, yet when it comes to determining breakouts or changes in price direction, volume is a very important indicator. For instance, if price is nearing a resistance level and volume is decreasing (increasing), this is seen as a bearish (bullish) sign. If volume is decreasing as price moves toward a resistance level, it signals that fewer people are willing to buy and sell at that price, which signals that the price trend will likely reverse at the resistance level. When a crypto/stock price resistance level is broken with high volume, this is considered a bullish sign as it shows many traders are willing to pay the premium for the equity. Figure 13.6 shows the bullish scenario. An example of a bearish volume scenario is shown in Figure 13.7, where volume is decreasing as price is increasing toward the upper resistance line.



13.3.3 Renko Chart

Renko charting is composed of bricks plotted at 45-degree angles, side by side with one another. In the standard **Renko chart**, each brick is the same size and reflects an up or down change of price that exceeds a threshold dollar value. For example, if a trader chooses a \$1 threshold, then a new Renko brick is plotted only if the price moves more than \$1, regardless of whether it takes one day or one month for the price change to exceed the threshold. The goal of a Renko chart is to filter out noise and aid traders in detecting price trend changes sooner and more clearly. Renko charting can also aid in identifying resistance and support level because it clears away a great deal of noise, better than a candlestick chart. Once a strong upward or downward trend forms, Renko traders can take advantage of the trend for a long time before a price trend in the opposite direction forms. Figure 13.8 shows an example of a Renko chart with a \$2 box threshold, where green is used for a price increase and red is for a price decrease.

The Renko trading signals are generated when the direction of the trend reverses and the bricks change color. For instance, a trader may sell a stock if a red box emerges after a sequence of ascending green boxes. Or, when there has been a strong trend upward, a trader might choose to buy long if a green brick appears right after a short-term pullback of one or two red boxes (labeled as a buying opportunity in Figure 13.8).

13.3.4 Moving Averages

Another term that is important to understand is the **moving average (MA)**, or simple moving average (SMA), which is a technical analysis tool that smooths historical price data information by generating a price average over a rolling time period range. If a range of 50 days is selected, on any given day, the MA50 gives the average price for the past 50 days. The MA is constantly updated for the average price as the rolling window advances.

Here is an example of how the moving average works. Suppose the prices in the past four days are: P1 = 15; P2 = 14; P3 = 16; and P4 = 17. The four-day MA is

$$MA4 = (15 + 14 + 16 + 17) \div 4 = 62 \div 4 = 15.5.$$

Renko chart

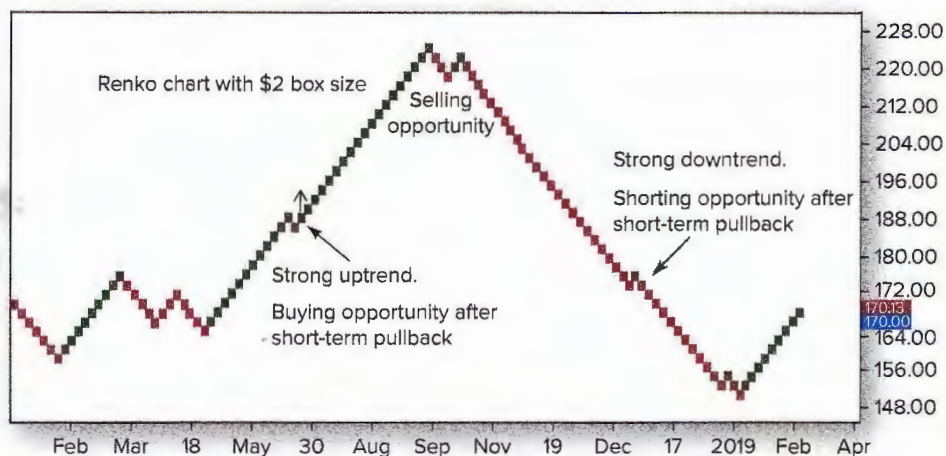
A price chart that consists of bricks to highlight price trends.

moving average (MA)

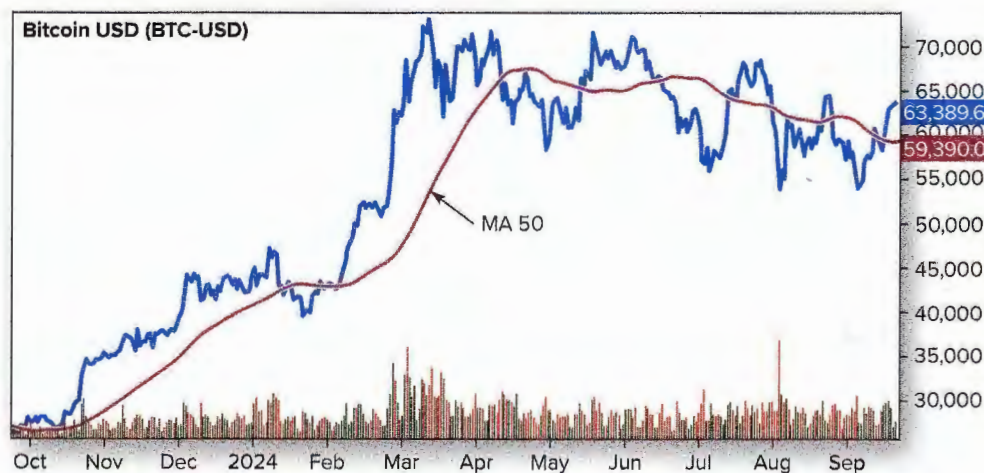
A widely used indicator in technical analysis that smooths out price data to create a single flowing line, helping to identify trends.

FIGURE 13.8**Renko chart**

Source: Investopedia.

**FIGURE 13.9****Bitcoin with a 50-day moving average**

Source: Yahoo! Finance.



If the next day's price is $P_5 = 14$, then the next MA is

$$MA_4 = (14 + 16 + 17 + 14) \div 4 = 61 \div 4 = 15.25.$$

Notice that the MA price changed between day four and day five by 0.25, from 15.5 to 15.25, while the actual price moved from 17 to 14, that is, a change of \$3. Therefore, the MA smooths the crypto/stock price and cleans and filters out some of the noisy, random price movements.

Figure 13.9 shows one year of bitcoin prices with a 50-day moving average. Note how much smoother the MA is compared to the price. Each time the price crosses the MA, the trader may decide to trade. Specifically, when a price crosses the MA from below, it is treated as a bullish sign. Crossing from above is a bearish sign.

There are several types of moving averages.

weighted moving average (WMA)

A moving average that assigns a larger weighting to more current data points since they are more relevant.

Weighted moving average (WMA). A variation of MA, WMA allocates a greater weighting to the most recent data points and gives lower weights to data points in the distant past. The WMA is attained by multiplying each number in the data set by a predetermined weight and then summing up the resulting values. For example, a five-period WMA would be calculated as follows:

$$WMA = \{(P_0 \cdot 50) + (P_1 \cdot 40) + (P_2 \cdot 30) + (P_3 \cdot 20) + (P_4 \cdot 10)\} \div (50 + 40 + 30 + 20 + 10)$$

Here, P_0 = current price; P_1 = previous period price; P_2 = two periods ago price; etc. The generic equation is

$$WMA = \frac{P_0 * n + P_1 * (n - 1) + \dots + P_n}{\left(n * \frac{n + 1}{2}\right)} \quad (13.7)$$

Exponential moving average (EMA). A variation of WMA, EMA is the weighted average of a sequence of recent data with exponentially increasing weight on the more recent data to emphasize the recent trend in the market. The weight of the EMA is exponentially tilted toward more recent crypto/stock price data, meaning that the most recent data has much greater influence in the moving average calculation. The key difference between EMA and WMA is weighting in the calculation, though both assign greater weights to more recent price data.

Volume-weighted moving average (VWMA). The VWMA highlights volume by weighting prices based on the amount of trading activity for a given trading time. While most MA models rely solely on the price data information, the VWMA includes volume into the equation by weighing prices based on the amount of trading activity. VWMA is a great technical analysis measure to identify trends based on the importance of recent price versus volume movements.

Hull moving average (HMA). This MA measure aims to minimize the lag of a traditional MA while maintaining the smoothness of the MA line. Established by Alan Hull in 2005, this indicator uses a function of three weighted MAs to highlight the latest values and considerably reduce lag. Indeed, HMA provides a trader with a great way to determine trends and the strength of a market. The traditional MA is used by most traders as a trading signal when the price line crosses the MA line. When the price closes/crosses above (below) the MA, they buy (sell). With the HMA, the trader avoids looking at crossovers on an MA line. Instead, the buy or sell signal for HMA is if the current HMA level is greater or less than the previous HMA value. This is generally depicted via the color change of the HMA, where the HMA is green for an upward trend in average price, and red for a downward trend.

Traders use the MA as an indicator for

- Superior identification of the resistance, support, and breakaway.
- Early identification of the momentum from overall movement of the price (i.e., regime change).
- Smoothing out crypto/stock price, thereby filtering out market noise to give traders a better sense of the direction.
- Better understanding and determining trendlines. MAs may be thought of as an adaptive trendline.
- Providing insight on when crypto/stock price is trading at a discount or at a premium.

13.4 Robust Trading Strategies

This section presents several trading strategies that may be a fit for crypto/stock trading. We consider three robust trading strategies. The first is the Bollinger Band strategy; the second is the Golden Cross strategy, also known as the bullish breakout pattern; and the third strategy is the RSI, which is a momentum-based trading strategy.

13.4.1 Bollinger Band Strategy

The **Bollinger Band** strategy is shown in Figure 13.10 for bitcoin. The upper and lower Bollinger Bands create the gray area. The volatile blue line within shows the bitcoin price. The smooth black line shows a 50-day moving average. The upper and lower boundary

exponential moving average (EMA)

A moving average that places a greater weight on the most recent data points and less weight on the oldest data points.

volume-weighted moving average (VWMA)

A moving average that incorporates both historical prices and volumes.

Hull moving average (HMA)

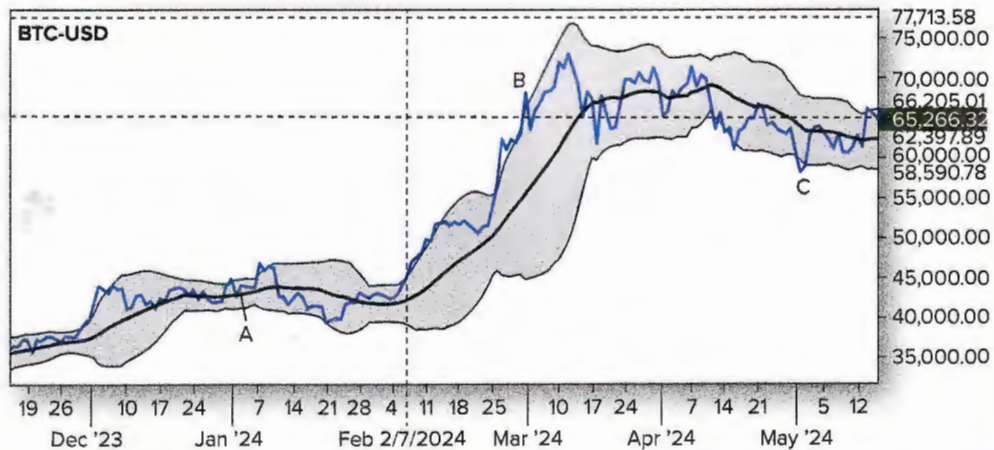
A moving average that uses weighted moving averages to create a smoother line.

Bollinger Band

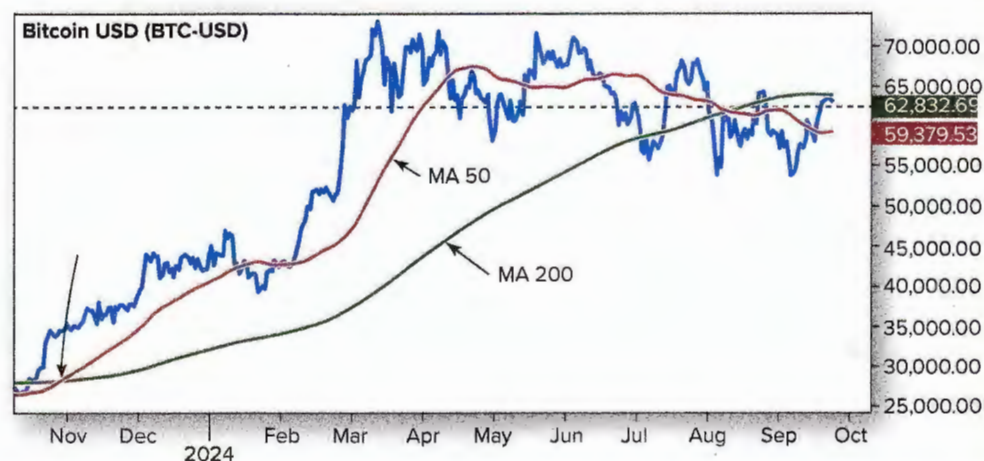
A volatility indicator that shows the range within which a security is trading, consisting of a moving average and two standard deviation lines.

FIGURE 13.10**Bitcoin with Bollinger Band trading strategy**

Source: Yahoo! Finance.

**FIGURE 13.11****Bitcoin with Golden Cross trading strategy**

Source: Yahoo! Finance.



lines are calculated as the moving average line for price plus or minus two standard deviations of the price line. Here we analyze three points labeled in red as A, B, and C, to illustrate the best trading strategy for bitcoin. First is point A. Here, the bitcoin price is near the 50-day moving average line. When the price is near the moving average, the best trading strategy is a neutral one; namely, do not change your current position.

Point B is where the price touches or exceeds the upper Bollinger boundary. At this point, bitcoin is **overbought** and thus, a trader owning it would sell it or take a short position. Finally, point C is where the price touches or drops below the lower boundary. At this point, bitcoin is considered **oversold**. A trader will buy at this point. The key advantage of this strategy is that it is very simple and intuitive as well as easy to apply.

overbought

A security believed to be trading at a level above its intrinsic value due to high purchasing demand.

oversold

A security believed to be trading at a level below its intrinsic value due to high selling supply.

Golden Cross

A chart pattern where a short-term moving average crosses above a long-term moving average.

13.4.2 Golden Cross Strategy

The **Golden Cross** strategy identifies a bullish breakout pattern as identified in the bottom left corner in Figure 13.11. This strategy is said to occur when a security or index's short-term moving average crosses above its long-term moving average from below. The figure shows an example with 50- and 200-day moving average lines. What traders often do is combine longer-term moving averages with shorter-term averages in this manner. The Golden Cross is one of the most widely used trading signals and is a bullish trend formation, signaling that price is expected to move up. However, if the short-term moving average crosses below the long-term moving average, then it is called a Death Cross and signifies a bearish trend, meaning price will likely move down. Note that there is a Death Cross at the upper

right-hand side of the figure. The most common crossover averages used by traders are the 9- and 21-day MA combination or the 50- and 200-day MA combination. In the figure, the Golden Cross occurs when the 200-day MA is crossed from below by the 50-day MA, which suggests upward momentum turning to a bull market, so we would buy the crypto fund.

The advantages of the Golden Cross are that it is a great indicator to filter out market noise and volatility as well as its ability to provide insights to suggest a trader's entry and exit points. Further, this strategy may offer great payoff ratios on trades. On the other hand, the disadvantages are that a trader may get whip-sawed if there is a quick reversal, which might potentially lead to very large losses if risk mitigation has not been implemented. Moreover, there may be long periods when the trader is out of the market and not trading while waiting for a Golden Cross formation to happen.

13.4.3 Relative Strength

The third trading strategy is the **relative strength index (RSI)** strategy, which is a popular momentum-based technical analysis oscillator that measures the relative magnitude of recent changes in price to determine the strength of the market and signal overbought and oversold conditions. Figure 13.12 illustrates the trading strategy. The RSI strategy considers any value over 70 to be overbought, a sell signal, while any value under 30 is considered oversold, a buy signal. There are many ways to use the RSI to trade; however, there are two main ways people trade using the RSI.

- **Method 1. Buy low relative strength, sell high relative strength.** This means that the trader buys when the $RSI \leq 30$ and sells when the $RSI \geq 70$. This is the most popular method. However, a trader must use it with caution because if the price is volatile, moving up and down frequently, there may be losses.
- **Method 2. Trade relative strength divergence patterns.** When the RSI is below 30 percent but there are rising RSI lows, the trader will buy when the RSI crosses back above the 30 percent line. In the other direction, the trader will sell declining RSI highs when the RSI crosses back below the 70 percent line.

The reasoning behind this strategy is shown in Figure 13.13, for a rising RSI lows divergence pattern. The RSI lows are increasing even as price is decreasing, which is a directional divergence signaling a future reversal to upward momentum. So, one would buy when the RSI crosses back above 30 percent. Finally, an additional trading strategy is the use of candlestick patterns to determine the state of the stock price, between bullish (rising), bearish (declining), and sideways or continuation.

relative strength index (RSI)

A momentum oscillator that measures the speed and change of price movements, used to identify overbought or oversold conditions.

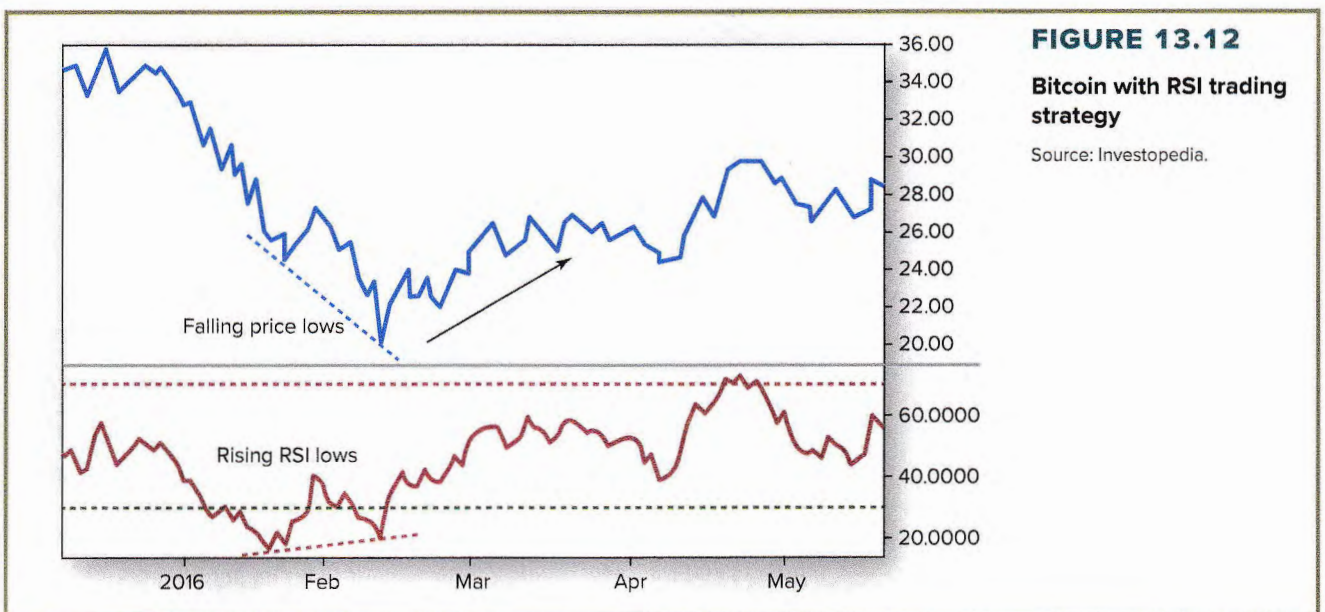
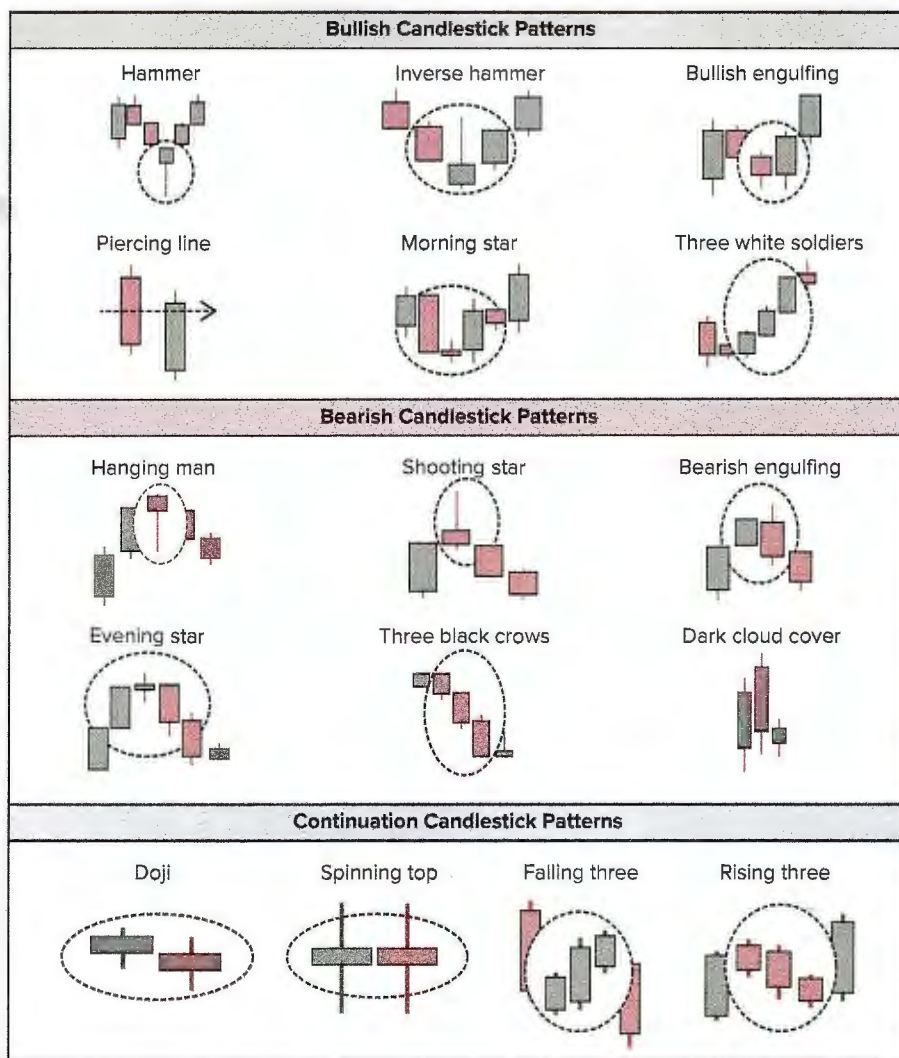


FIGURE 13.12
Bitcoin with RSI trading strategy

Source: Investopedia.

FIGURE 13.13**Candlestick pattern trading strategy**

Etsy/Pinterest/Courtesy of Jack Curtis.



This section has covered many technical analysis trading tools. Table 13.3 summarizes these tools and their associated trading signals.

Finally, it is important to mention that these short-term crypto/stock trading strategies are alternatives to a long-term buy and hold crypto/stock strategy. The buy and hold strategy involves the investor selecting crypto/stocks or ETFs that match the investor's goals and objectives for the long run; a buy and hold investor does not respond to fluctuations in the economy or to stock price movement. There are several advantages of a buy and hold strategy, one of which is that it is great for investors who do not have time to follow the market. There is also the advantage of reduced capital gains tax for longer holding periods, whereas short-term trading gains are taxed at the trader's full income tax rate. Also, the longer the holding period, the higher the probability of positive returns; for example, holding the S&P index for long periods has historically produced annual returns averaging 10 percent. Furthermore, it helps investors to avoid panic selling. On the other hand, there are two key disadvantages to the buy and hold strategy. First, the investor has exposure to large drawdown/loss, such as during the bear market in 2022; and second, the investor may miss out on possible positive Alpha (excess performance above the market benchmark) potentially available from short-term trading.

Much literature is available about optimal entry and exit from the stock market; this literature suggests that a stock/crypto holder might benefit from an active market timing strategy of when to enter and exit the entire financial market. A key study that is easy and

TABLE 13.3 | Comparison of Technical Analysis Tools

Tool	Type	Calculation Basis	Buy Signal	Sell Signal	Notes
Support and resistance levels	Price action	Horizontal price levels where price historically reverses	Price bounces off support (bottom level)	Price falls at resistance (top level)	Subjective; best used with confirmation signals
Simple moving average (SMA)	Trend-following	Average of closing prices over a period	Price crosses above SMA (bullish crossover)	Price crosses below SMA (bearish crossover)	Reacts slowly; good for identifying overall trend
Weighted moving average (WMA)	Trend-following	More weight to recent prices	Price crosses above WMA	Price crosses below WMA	More responsive than SMA; sensitive to short-term changes
Exponential moving average (EMA)	Trend-following	Exponentially weighted recent prices	Price crosses above EMA or EMA turns upward	Price crosses below EMA or EMA turns downward	Faster response than SMA/WMA; popular for short-term trading
Volume-weighted moving average (VWMA)	Trend + volume-based	Average weighted by volume	Price rises above VWMA on high volume	Price falls below VWMA on high volume	Reflects both price and volume; useful in active markets
Hull moving average (HMA)	Trend-following	Weighted and smoothed to reduce lag	HMA curves upward or price crosses above HMA	HMA curves downward or price crosses below HMA	Very responsive with low lag; great for dynamic markets
Bollinger Bands	Volatility-based	SMA with upper/lower bands at two standard deviations	Price touches or breaks lower band plus oversold signal	Price touches or breaks upper band plus overbought signal	Useful for spotting volatility and price extremes
Relative strength index (RSI)	Momentum oscillator	Measures speed of price changes (0–100 scale)	RSI <30 indicates oversold (potential buy)	RSI >70 indicates overbought (potential sell)	Strongest when combined with trend or pattern analysis

simple to follow, and based on fundamentals, is the research article by Yosef Bonaparte (2020), titled “The VIX Is Your FIX: A Flexible Strategy to Timing the Stock Market.” This study shows that when VIX is below 23, the stock market will have a positive future return and will be negative otherwise.¹

13.5 AI Stocks and ETFs

13.5.1 ETFs and Stocks

This section focuses on top AI **exchange traded funds (ETFs)** and stocks. An ETF is a portfolio of stocks that is represented by one ETF stock that can be bought, sold, and shorted. Owning one ETF gives the investor exposure to all the stocks in the portfolio. The initial list of the top ETFs and stocks is identified by U.S. news sources along with their respective analyses. Subsequently, a stock valuation framework is outlined. Table 13.4 presents the top ETFs listed by the U.S. news.

Table 13.5 displays the ETF name, ticker, five-year performance, beta, and top holdings. An excellent fund would exhibit a low beta (a measure of ETF risk) and high five-year performance. Additionally, the key holding of the fund typically includes major technology companies such as Tesla, Meta, Apple, Microsoft, and NVIDIA.

exchange traded funds (ETFs)

An investment that pools a group of securities and issues a stock representing the portfolio that can be traded like an individual stock.

TABLE 13.4 | Top AI ETFs (based on the U.S. news)

ETF Name	Ticker	Expense Ratio (%)
Global X Artificial Intelligence and Technology	AIQ	0.68%
Global X Robotics and Artificial Intelligence	BOTZ	0.69
First Trust Nasdaq Artificial Intelligence and Robotics	ROBT	0.65
iShares Exponential Technologies	XT	0.46
Ark Autonomous Technology and Robotics	ARKQ	0.75
ETFMG AI Powered Equity	AIEQ	0.75

¹https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3642676

TABLE 13.5 | Analyzing AI ETFs

ETF Name	Ticker	Performance (%)		Beta	Top Holdings
		Five Years	Jan. 1, 2023 to May 11, 2023		
Global X Artificial Intelligence and Technology	AIQ	59.42%	19.25%	1.21	META 4.78% NVDA 4.12% MSFT 3.61% AAPL 3.43% CRM 3.62%
Global X Robotics and Artificial Intelligence	BOTZ	6.57	23.99	1.35	ISRG 10.01% NVDA 9.05%
First Trust Nasdaq Artificial Intelligence and Robotics	ROBT	36.76	14.56	1.31	AVAV 2.28%
iShares Exponential Technologies	XT	38.21	8.2	1.14	META 1.02% NVDA 0.83%
Ark Autonomous Technology and Robotics	ARKQ	35.4	14.17	1.44	TSLA 12.59%
ETFMG AI Powered Equity	AIEQ	0.54	2.43	1.11	DHI 4.91% ISRG 4.9%

TABLE 13.6 | Top AI Companies

Company	Ticker	Details
Microsoft Corp.	MSFT	Software giant Microsoft invested \$1 billion in OpenAI in 2019 and 2021 as part of a partnership that made Microsoft Azure OpenAI's exclusive cloud provider.
Alphabet Inc.	GOOG/GOOGL	Google launched its Bard AI chatbot in March, and the company has been investing heavily in AI technology for several years now.
NVIDIA Corp.	NVDA	High-end chipmaker NVIDIA provides the massive processing power needed to run advanced AI applications.
Taiwan Semiconductor Manufacturing Co. Ltd.	TSM	TSM is the world's largest pure-play semiconductor foundry.
Meta Platforms Inc.	META	Meta Platforms is a market leader in social media and online advertising and the owner of Facebook, Instagram, and other platforms.
ASML Holding NV	ASML	ASML produces photolithography systems and other processing equipment used in semiconductor fabrication.
SAP SE	SAP	SAP is a global leader in enterprise resource planning software solutions.
Relx PLC	RELX	AI has also made the company's offerings more sophisticated, valuable, and appealing to customers.
Baidu Inc.	BIDU	Baidu is the leading Chinese internet search provider. The company also has several other businesses, such as its majority stake in streaming video platform iQiyi Inc.
Arista Networks Inc.	ANET	Arista Networks supplies cloud networking solutions to internet companies, cloud service providers, and enterprise data centers.

Instead of owning many AI firms in an ETF, a trader can buy or trade individual AI stocks. Top AI stocks identified by the U.S. news are shown in Table 13.6. This table presents the company name, ticker, and details provided by the U.S. news.

13.5.2 AI Fundamental Stock Valuations

This section outlines an approach to corporate or stock valuation while considering the new AI innovation. This methodology revolves around two main themes: (1) fundamentals, and (2) behavior based on the technology sentiment index. The former involves factors such as the PE ratio and research and development (R&D) expenditure relative to revenue, while the latter focuses on monitoring the Google trend of key technological terms.

Beginning with the PE ratio, the model projects that the future price of a company is determined based on both the current and future PE ratios:

$$P_j^{Future} = P_j^{Current} * \left(\frac{PE^{Current}}{PE^{Future}} \right) \quad (13.8)$$

If the current PE is lower than the future PE , we anticipate greater earnings growth, indicating a potential price increase based on the expected future earnings.

Consider NVIDIA (NVDA), a company providing hardware to the AI sector. The question arises whether the company is overbought or if there is still upside potential. As of September 24, 2024, NVDA's current price was \$120.87 with a current PE ($PE^{Current}$) of 56.75. A future one-year PE (PE^{Future}) estimate of 65 means the projected future price is calculated as $\$120.87 \times (65/56.75) = \138.44 . Based on these metrics, NVDA is expected to experience further growth, indicating significant upside potential for the future one-year target. Note that NVIDIA has conducted six stock splits over the life of the firm, but the June 10, 2024, split was a massive 10:1 split, which gave every shareholder 10 shares for every one they owned. This also changed the price from \$1,200 to \$120. Refer to <https://finance.yahoo.com/quote/NVDA/> for the current stock price.

Now, we explore a hypothetical scenario where the future PE is 40. In this case, the future price would be $\$120.87 \times (40/56.75) = \85.19 . This suggests that the current price for NVIDIA is considerably overbought and expensive. While NVIDIA remains a strong AI company, its current price is inflated relative to its earnings. This discrepancy does not indicate a problem with NVIDIA's business operations but rather suggests that, in this hypothetical scenario, the price has outpaced earnings, necessitating time for alignment.

The second valuation model focuses on R&D relative to revenue growth. This model assesses the extent to which R&D investment contributes to revenue growth. While it would be ideal to have specific data on R&D in AI, we can still utilize overall R&D as a proxy. The model operates as follows:

$$\text{Revenue growth}_{t+1}^j = \text{Constant} + \alpha * \text{Revenue growth}_t^{S\&P} + \beta * R\&D_t^j + \varepsilon_t \quad (13.9)$$

In this model, $\text{Revenue growth}_{t+1}^j$ represents the revenue growth for company j at time $t + 1$, while $\text{Revenue growth}_t^{S\&P}$ indicates the revenue growth for the S&P 500 Index at time t , with α and β being parameters to estimate. Then, ε_t represents the unobservable error term. If β is greater than 0 and statistically significant, it indicates that R&D significantly contributes to revenue growth. Moreover, the higher the value of β , the more innovative the company is.

Here is a hypothetical example. Regression analysis results of a company's revenue growth relative to the revenue growth of the S&P 500 Index is:

$$\text{Revenue growth}_{t+1}^j = 0.2 + 0.6 * \text{Revenue growth}_t^{S\&P} + 0.00075 * R\&D_t^j + \varepsilon_t$$

In this case, the baseline revenue growth is 0.2 or 20 percent. Moreover, an $\alpha = 0.6$ means the overall economy (as measured by the S&P 500 companies), which reflects macroeconomic growth, *positively* impacts the growth of the company. Notice that $\alpha < 1$, which means that for every 1 percent growth of the S&P 500 revenue, the company will grow by less than 1 percent, namely, 0.6 percent.

Important to this analysis, $\beta = 0.00075$, indicating that for every \$1 of R&D investment, revenue grows by 0.00075 percent. Therefore, if the company invests \$1,000, revenue growth next year will be 0.75 percent. While one might perceive β as small, it is influenced by the scale of the R&D variable. If the R&D investment is in millions of dollars, β would increase accordingly.

13.5.3 AI Stock Valuation: Behavioral

The final step involves assessing the company's connection to AI. We use the Google Trends model to gauge its association with AI technology. Using NVIDIA's sales revenue, its position as one of the leading AI companies is certain. To gauge this connection, examine the correlation between the Google Trends index and NVIDIA's stock price, serving as a proxy for the company's attachment to AI technology.

Use several technological terms, such as

- Artificial intelligence (AI)
- Neural network (NN)
- Large language model (LLM)
- Machine learning (ML)
- Generative AI (GenAI)
- Deep learning (DL)

For this example, the initial term *convolutional neural network* (CNN) was employed but observed weak results. Subsequently, the term *neural network* (NN) was used to assess the correlation between these terms and the returns of NVIDIA, Microsoft, and Google stocks. We initiated the analysis by examining Google searches for the term *artificial intelligence* over a 24-hour period and on a weekly basis. Figure 13.14 illustrates the search pattern during the day, focusing on the period between May 15, 2024, and May 16, 2024. Notably, the search peaks at midnight and in the early morning hours.

Additionally, Figure 13.15 illustrates the weekly search trends (hourly) for the same period from May 10, 2024, to May 16, 2024. The peak search activity throughout the day is shown, with no distinct peak on any day of the week. It is worth noting that similar patterns are observed when analyzing longer time frames for both daily and weekly search trends.

These search results are then correlated with the company stock returns in the following section.

13.5.4 AI Stock Valuation Index

This section introduces a framework for analyzing the deployment of an AI Stock Valuation Index (AI-SVI). This index serves as an AI sentiment gauge, reflecting the degree to which stock prices and returns are influenced by developments and news related to AI technology.

FIGURE 13.14

Daily search trends for the term *artificial intelligence*

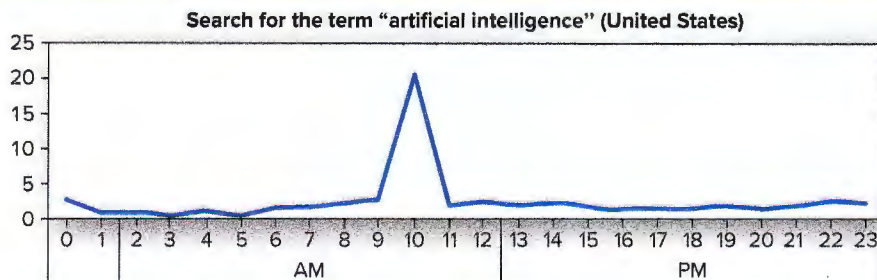
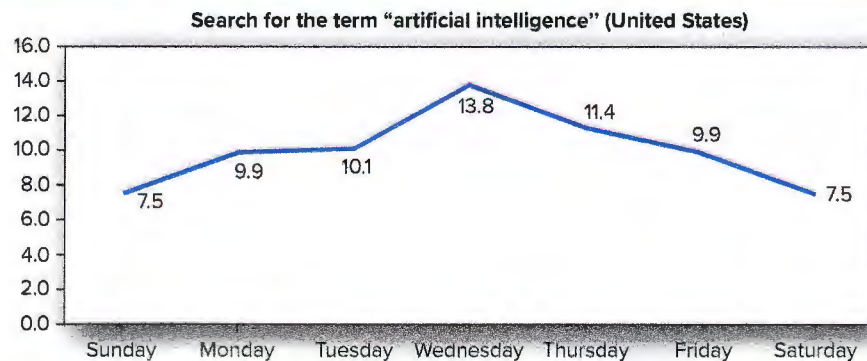


FIGURE 13.15

Search for the term *artificial intelligence* during the week (between June 2, 2023 and June 8, 2023)



Sample size, particularly the duration of the data period, is a crucial parameter for the analysis. The Google search report data spans from January 2004 to the present. However, correlation during this entire period differs significantly from that of the past five years, two years, and even the last year. This difference suggests a recent surge in attention toward AI, especially over the past year. Table 13.7 presents the findings for the 12 months, spanning from June 2022 to May 2023. Column 1 lists the search terms; columns 2 and 3 display the sum and mean of these search terms; and columns 4, 5, and 6 showcase the correlation between the stock return (NVIDIA ticker NVDA, Microsoft ticker as MSFT, and Google ticker as GOOG, respectively) and the search volume for each term.

From the findings in the table, it is evident that machine learning exhibits the highest correlation with NVDA stock returns, followed by artificial intelligence. Similarly, for MSFT, machine learning and deep learning show significant sensitivity, followed by neural networks. As for GOOG, neural networks and deep learning demonstrate the highest sensitivity to its returns.

Expanding the analysis over the past five years, using the same Google trend search terms, yields markedly different results. Table 13.8 shows that the correlations are much lower and the search volume is significantly reduced. These results underscore the recent emergence of AI enthusiasm as a notable phenomenon.

The last row shows the sum of all terms and their corresponding correlation with the stocks.

Next is the final process to construct the AI in Finance Index (AI-FINX), which gauges the sensitivity of stocks to developments in the AI sector. Building upon the insights from previous tables, the following matrix is presented in Table 13.9. The first column lists the search terms, while the second column provides the weight of each term relative to the total number of searches. For instance, considering the data from Table 13.4, the sum of searches for *artificial intelligence* is 683 out of a total of 3,904 searches, yielding a

TABLE 13.7 | Co-Movement of AI Sentiment Terms with Stock Returns in the Last 12 Months

Term to Search	Sum	Mean	Correlation: Term and Stock		
			NVDA (%)	MSFT (%)	GOOG (%)
Artificial intelligence	683	56.9	35.41%	36.78%	48.73%
Neural network	697	58.1	29.40	48.85	52.41
Large language model	287	23.9	22.55	35.57	46.49
Machine learning	1,051	87.6	39.95	62.41	41.43
Generative AI	205	17.0	16.49	28.86	38.87
Deep learning	981	81.8	31.07	62.26	51.46
Sum	3,904	325.3	30.15	44.59	51.25

TABLE 13.8 | Co-Movement of AI Sentiment Terms with Stock Returns in the Last Five Years (May 2019 to May 2024)

Term to Search	Sum	Mean	Correlation: Term and Stock		
			NVDA (%)	MSFT (%)	GOOG (%)
Artificial intelligence	2,646	44.1	19.5%	14.2%	13.5%
Neural network	3,108	51.8	-11.5	-5.5	-14.4
Large language model	347	5.8	20.3	15.0	20.3
Machine learning	4,463	74.4	-0.7	-3.1	-15.3
Generative AI	224	3.7	17.4	13.0	17.6
Deep learning	4,536	75.6	-10.1	-0.5	-15.5
Sum	15,324	255.4	7.7	7.2	2.0

TABLE 13.9 | AI Sentiment Terms and Their Co-Movement with Stock Returns
Over the Past Five Years (May 2019 to May 2024)

Term to Search	Weight (%)	Weighted Search and Stock Return Correlation			Average (%)
		NVDA (%)	MSFT (%)	GOOG (%)	
Artificial intelligence	17.5%	6.2%	6.4%	8.5%	7.1%
Neural network	17.9	5.2	8.7	9.4	7.8
Large language model	7.4	1.7	2.6	3.4	2.6
Machine learning	26.9	10.8	16.8	11.2	12.9
Generative AI	5.2	0.9	1.5	2.0	1.5
Deep learning	25.1	7.8	15.6	12.9	12.1
Sum	100.0	32.5	51.7	47.4	43.9

share of 17.5 percent, as shown in Table 13.7. Columns 3, 4, and 5 represent the weights of each search term based on its correlation with NVIDIA, Microsoft, and Google stocks, respectively. Finally, the last column displays the average weighted correlation across the stocks.

The final row shows the total, with all search terms summing up to 100 percent. For NVIDIA, the weighted sum of search term correlations with stock returns is 32.5 percent, for Microsoft it is 51.7 percent, and for Google it is 47.4 percent. The weighted average for these stocks totals approximately 43.9 percent.

This matrix enhances a trader's understanding of the relationship between artificial intelligence and finance and can serve as an index to measure a stock's sensitivity to the AI field.

Summary

This chapter presents the fundamental concepts and advanced techniques necessary to navigate the complexities of AI stock investing and cryptocurrency trading in modern financial markets. It provides a comprehensive understanding of market analysis, risk management, technical and fundamental analysis, and the unique challenges and opportunities presented by cryptocurrency trading. There is much potential for high returns investing

and trading in cryptoassets and AI stocks, but there is also great risk involved. Fundamental analysis examines the financial success of the business in comparison to its stock price. Technical analysis assesses the supply and demand of an asset through price and volume patterns. These patterns help traders understand price trends. Technical analysis is the popular trader evaluation for cryptocurrency and robust strategies were reviewed.

Keywords

algorithmic trading - A method of executing buy and sell orders using automated pre-programmed trading instructions. *p.* 233

Bollinger Band - A volatility indicator that shows the range within which a security is trading, consisting of a moving average and two standard deviation lines. *p.* 247

breakout - Occurs when an asset's price crosses over a resistance level or falls below a support level. *p.* 242

candlestick chart - A type of price chart used in technical analysis that displays the high, low, open, and closing prices of a security for a specific period. *p.* 242

current ratio - Measures whether a firm has enough resources to meet its short-term obligations. *p.* 237

debt-to-equity ratio - Shows the firm's financial leverage through the proportion of a company's debt compared to its assets. *p.* 237

discounted cash flow (DCF) - The value of an investment based on its expected future cash flows. *p. 238*

exchange traded funds (ETFs) - An investment that pools a group of securities and issues a stock representing the portfolio that can be traded like an individual stock. *p. 251*

exponential moving average (EMA) - A moving average that places a greater weight on the most recent data points and less weight on the oldest data points. *p. 247*

fundamental analysis - Evaluating a stock's intrinsic value by examining related economic, financial, and other qualitative and quantitative factors. *p. 233*

Golden Cross - A chart pattern where a short-term moving average crosses above a long-term moving average. *p. 248*

Hull moving average (HMA) - A moving average that uses weighted moving averages to create a smoother line. *p. 247*

intrinsic value - The perceived and/or computed true value of an investment asset. *p. 234*

long position - Investment position in which the investor owns the asset and obtains value when its price increases. *p. 242*

moving average (MA) - A widely used indicator in technical analysis that smooths out price data to create a single flowing line, helping to identify trends. *p. 245*

net profit margin - Financial ratio that measures a company's profit as a percentage of its revenue. *p. 237*

overbought - A security believed to be trading at a level above its intrinsic value due to high purchasing demand. *p. 248*

oversold - A security believed to be trading at a level below its intrinsic value due to high selling supply. *p. 248*

PEG ratio - The price/earnings-to-growth ratio measures how expensive a stock is relative to its growth rate. *p. 237*

price-to-earnings (P/E) ratio - A popular ratio used for assessing relative value of a company. *p. 236*

put/call ratio - This ratio measures the proportion between all put options and all call options purchased on any given day to determine investor sentiment. *p. 238*

relative strength index (RSI) - A momentum oscillator that measures the speed and change of price movements, used to identify overbought or oversold conditions. *p. 249*

Renko chart - A price chart that consists of bricks to highlight price trends. *p. 245*

return on assets (ROA) - ROA measures the profitability of a business in relation to its total assets. *p. 237*

return on equity (ROE) - ROE measures the profitability of a business in relation to its shareholders' equity. *p. 237*

risk management - A process of determining the risks that exist in an investment and then mitigating those risks. *p. 233*

sentiment indices - Graphical or numerical indicators designed to show how a population feels about the market or economy. *p. 238*

short position - An investment position created when a trader sells a security first with the intention of repurchasing it or covering it later at a lower price. *p. 242*

support and resistance levels - Price levels where a stock frequently reverses direction, used to identify potential entry and exit points. *p. 242*

technical analysis - The study of statistical trends from trading activity, such as price movement and volume, to predict future price movements. *p. 233*

technical indicators - Mathematical calculations based on the price and/or volume of a security to predict the future price trend. *p. 238*

volume-weighted moving average (VWMA) - A moving average that incorporates both historical prices and volumes. *p. 247*

weighted average cost of capital (WACC) - A representation of a firm's blended cost of capital across all capital sources, including common shares, preferred shares, and debt. *p. 238*

weighted moving average (WMA) - A moving average that assigns a larger weighting to more current data points since they are more relevant. *p. 246*

Questions and Activities

- 13.1 Describe the main characteristics of fundamental analysis.
- 13.2 List and describe the forms of non-fundamental analysis.
- 13.3 Describe how fundamental analysis differs from technical analysis.
- 13.4 How are support and resistance lines used for a robust trading strategy?
- 13.5 What is a candlestick chart and how is it used in technical analysis?
- 13.6 What is moving average (MA)? What types of MAs are available, and how do they differ?
- 13.7 How is trading volume used to interpret price breakouts?
- 13.8 Explain the Golden Cross trading strategy.
- 13.9 Explain the RSI trading strategy.
- 13.10 What are the current AI-oriented ETFs and how do their portfolio holdings differ?

Academic Analysis

Yosef Bonaparte, "Artificial Intelligence in Finance: Valuations and Opportunities," *Finance Research Letters* 60 (2024): 104851, ISSN 1544-6123, <https://doi.org/10.1016/j.frl.2023.104851>.

This study explores the financial opportunities emerging from new AI innovations. First, it presents current and projected AI revenue for the coming decade. Next, it introduces a valuation model for AI stocks and ETFs that incorporates both fundamental and sentiment analyses. Two primary models for stock valuation are proposed. The analyses can serve as a benchmark framework for stock valuations and their impact on AI technology. This study is particularly significant as there is an enthusiastic embrace of AI technology, potentially indicating the financial market's entry into an AI bubble.

Questions

1. What is the current and projected AI revenue for the next decade?
2. How does the valuation model for AI stocks and ETFs incorporate both fundamental and sentiment analyses?
3. Briefly describe the two primary models for stock valuation.

Adrian Mitroi and Ion Stancu, "Behavioral Finances Versus Technical and Fundamental Analysis," *Theoretical and Applied Economics*, Asociatia Generala a Economistilor din Romania—AGER 1, no. 506 (2007, January).

Despite impressive advancements in modern finance, explaining why people behave irrationally when dealing with money remains challenging on a scientific basis. Classical finance assumes that individuals make rational and optimized financial decisions. Behavioral finance, however, emphasizes the importance of understanding what investors actually do, complementing classical finance by focusing on real-world economic behavior. The emerging field of neuroeconomics delves into the intricate and profound interactions within the human brain when confronted with economic uncertainties. Fundamental psychological traits such as fear, anger, greed, and altruism significantly influence our financial decisions. Human decision-making involves a complex interplay between intellect (understanding a situation),

reason (considering long-term consequences), and emotion (judging the course of action).

Questions

1. Describe rational and irrational financial behavior.
2. Describe the difference between classical finance and behavioral finance.
3. How does neuroeconomics impact financial decisions?
4. What are the psychological influences on financial decisions?

F. Fang, C. Ventre, M. Basios, et al., "Cryptocurrency Trading: A Comprehensive Survey," *Financial Innovation* 8, no. 13 (2022): <https://doi.org/10.1186/s40854-021-00321-6>.

In recent years, the number of financial institutions incorporating cryptocurrencies into their portfolios has accelerated. Cryptocurrencies are the first purely digital assets to be included by asset managers. While they share some similarities with traditional assets, cryptocurrencies possess unique characteristics, and their behavior as an asset class is still being learned. It is crucial to summarize existing research on cryptocurrency trading, including available trading platforms, trading signals, trading strategy research, and risk management.

This paper provides a comprehensive survey of cryptocurrency trading research, encompassing 146 studies on various aspects of the field. Topics covered include cryptocurrency trading systems, bubbles and extreme conditions, volatility and return prediction, cryptoasset portfolio construction, technical trading, and more. Additionally, the paper analyzes data sets, research trends, and the distribution of research objects (content/properties) and technologies. The paper concludes by highlighting promising opportunities that remain unexplored in cryptocurrency trading.

Questions

1. Describe the adoption of cryptoassets into institutional portfolios.
2. Pick one research topic described in the paper and summarize the research and its importance.
3. What are the future opportunities described in the paper?

Case Study

Palantir Technologies: A Fundamental Analysis of a Controversial AI Powerhouse

Palantir Technologies states that its core mission is to “integrate data, humans, and machines to solve the most important problems.” It represents a fascinating and complex case study for fundamental analysis, intertwining cutting-edge technology, unique business models, ethical considerations, and evolving market dynamics. The case moves beyond surface-level observations to analyze the company’s strengths, weaknesses, opportunities, and threats.

Connect provides

- Description of Palantir’s business model
- Discussion of the industry and competitors
- Financial performance
- Stock price performance
- Additional readings
- Questions

Would you invest in this company, whose name derives from the all-seeing “Palantíri” stones in J.R.R. Tolkien’s Lord of the Rings?