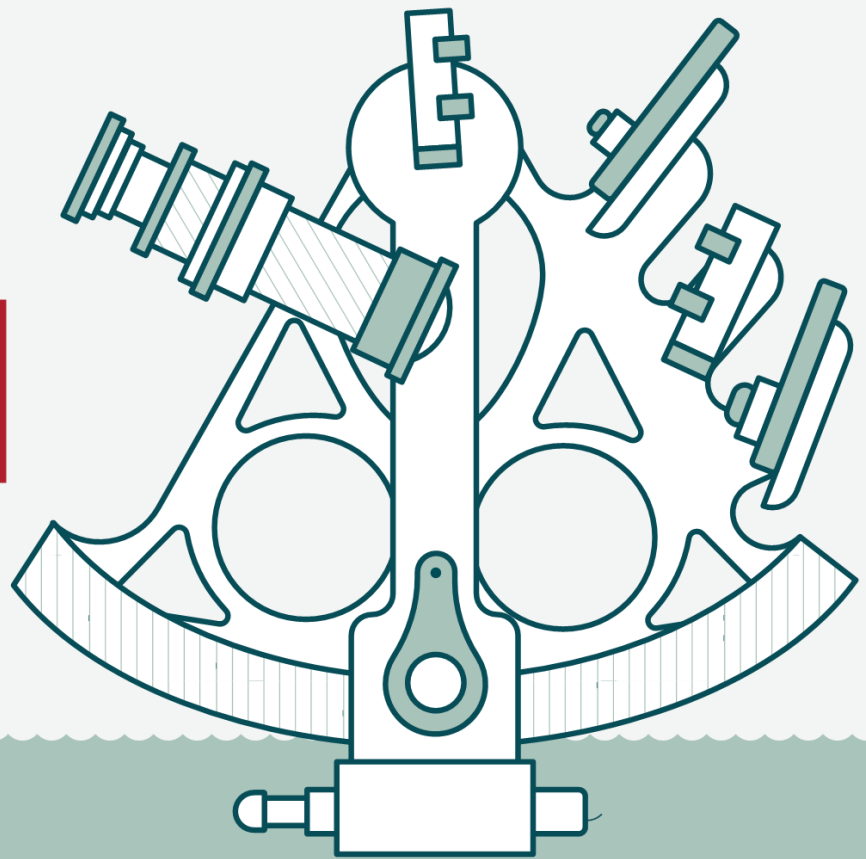


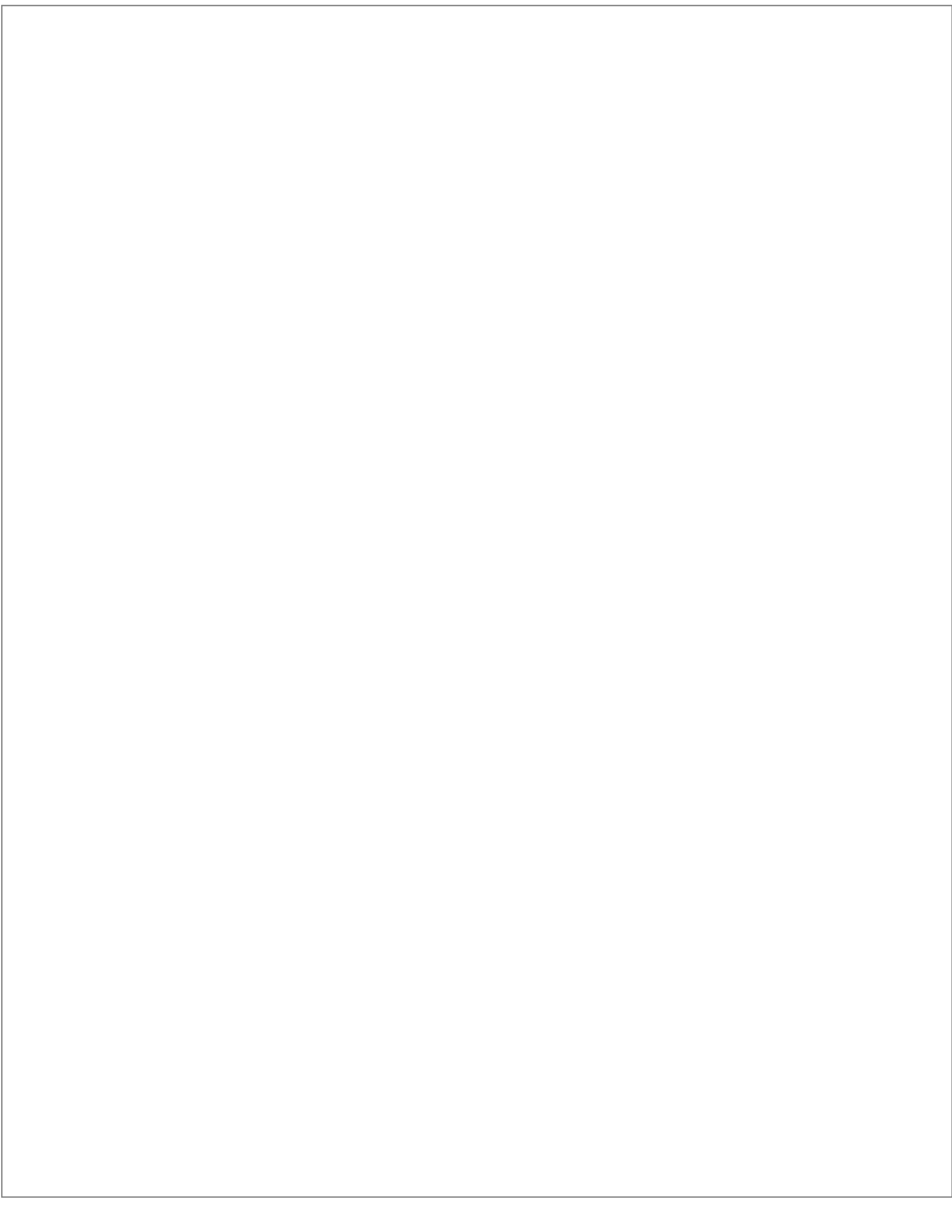
# CMT LEVEL II CURRICULUM

**2024** CHARTERED MARKET  
TECHNICIAN EXAM

THE THEORY & ANALYSIS  
OF **TECHNICAL ANALYSIS**



# **CMT LEVEL II**



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# CMT LEVEL II

The Theory and Analysis  
of Technical Analysis

*Readings Selected by*

**The CMT Association**



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### ■ The CMT Association

#### What We Do

The CMT Association, founded in the 1960s, is a not-for-profit professional association dedicated to advancing the discipline of technical analysis and the work of technical analysts worldwide. The Association pursues this mission through credentialing, ethics, education, and advocacy.

- **Credentialing:** The CMT Charter is the globally respected credential granted to Association members in good standing who complete the examination process. Charterholders have demonstrated mastery of a core body of knowledge in both the history and current practice of technical analysis. Their ongoing membership in the CMT Association is evidence of their commitment to the professional and ethical practice of the craft.
- **Ethics:** The CMT Association and its members are committed to maintaining the highest ethical standards in all their professional activities. The Association has adopted the CFA Institute Code of Ethics and Standards of Professional Conduct for its membership. In fact, questions on ethics appear on all three levels of the CMT exams. Furthermore, members risk disciplinary sanctions by the CMT Association including revocation of membership and the right to use the CMT designation for violating the Code and Standards.
- **Education:** The Association's dedication to education extends beyond the curriculum it maintains for candidates in the CMT Program. Through webcasts, local chapter meetings, and an Annual Symposium, the Association promotes ongoing learning and intellectual synergies among all those interested in technical analysis.

- **Advocacy:** The Association represents the technical analysis community to the public, to academia, and to regulatory bodies worldwide. This work is intended to secure the place of technical analysis as a recognized discipline alongside other modes of financial market analysis, and to make the public aware of its strengths and limitations.

## **Who We Are**

The membership of the CMT Association includes technical analysts, portfolio managers, investment advisors, market-letter writers, journalists, and academics. With CMT charterholders in more than 50 countries, members are involved in global markets from currencies to commodities, equities to ETPs, and futures to fixed income.

The membership honors the long history of technical analysis of financial markets while generating new methods that incorporate the latest concepts in behavioral finance, quantitative analysis, and algorithmic applications.

## **Governance and Operation**

The CMT Association is overseen by a Board of Directors elected from and by the membership. Additional work on behalf of the Board and the membership is carried out by committees composed of members who volunteer their time and expertise. Dozens of local chapters, found in many countries, offer opportunities to hear from renowned technicians and network with others who share a passion for technical analysis. New members as well as veterans are encouraged to become involved in chapters and on committees.

The staff of the Association, headquartered in New York, supports the Board and the membership in carrying out the mission of the Association. Members should feel free to contact staff for information related to the activities and workings of the CMT Association, volunteer opportunities, and the credentialing program.

## ■ **The CMT Program**

### **Purpose**

The CMT Association initiated a professional credentialing program in technical analysis in the 1980s. This program is an essential part of the Association's work in advancing the practice of technical analysis and maintaining the highest possible professional standards for practitioners. By designing the curriculum and setting standards for examinations, ethics, and professional experience, the Association assures that candidates satisfy the stated requirements to be awarded the CMT Charter.

The CMT Program is overseen by the Curriculum and Test Committee of the CMT Association. The Committee is composed of volunteer charterholders who are distinguished by their dedication to technical analysis and their willingness to contribute to its advancement. The Committee approves the curriculum and monitors the exam content and administration.

## Curriculum

The CMT Program curriculum is published in three volumes—one for each level of the exam series. The readings are drawn primarily from published texts written by recognized experts with additional content commissioned by the CMT Association.

The three levels of the curriculum are described as follows:

- Level I: Introduction to Technical Analysis: Basic knowledge of the terminology and analytical tools used in technical analysis.
- Level II: Theory and Analysis: Application of concepts, theory, and techniques.
- Level III: Integration of Technical Analysis: Integration of concepts with practical application.

The specific topics covered in each level of the curriculum have been determined by a job-analysis survey of technical analysis practitioners. The information from the survey, updated periodically, is used to create a list of knowledge domains, subdomains, and weightings for each level of the curriculum and exam. In addition, each of the three exams includes “ethics” as a knowledge domain.

## Exams

All three levels of the CMT Association exams are administered during semiannual test windows in June and December. The exact dates for each test window are announced well ahead of time. Candidates complete the exams on computer terminals at Prometric Test Centers located worldwide. Candidates may sit for only one exam during each test window. Furthermore, candidates should be aware that the CMT Association exams are offered only in English regardless of the location of the test center.

### CMT Exams

Level	Format	Duration	Content
I	Multiple choice	2 hours	132 questions: 120 scored, 12 trial
II	Multiple choice	4 hours	170 questions: 150 scored, 20 trial
III	Multiple choice and short answer	4 hours	Approximately 50, but varies at each administration

## Receiving the CMT Charter

To be awarded the CMT charter, candidates must:

- Successfully complete all three exams. (CFA charterholders may request a waiver from Level I of the CMT exams.)
- Attain professional membership in the CMT Association, which requires:
  - Sponsorship by three members in good standing, and
  - Satisfying the stipulation for professional experience.

- Remain current on dues.
- Complete and maintain an accurate Personal Conduct Statement.

## ■ The Level II Textbook

As noted above, the CMT Level II exam is a 4-hour multiple-choice exam focused on the application of concepts, theory, and techniques. The knowledge domains listed in the table below, and their weightings, are covered in the Level II text and reflected on the exam. Although this may be a useful checklist for some readers, candidates may be best served by focusing on the Learning Objective Statements that appear at the start of each chapter. These are described in another section below.

### Level II: Knowledge Domains and Weightings

Domain	Weight
Theory and History	5%
Market Indicators	8%
Construction	3%
Trend Analysis	15%
Chart and Pattern Analysis	15%
Confirmation	6%
Cycles	3%
Selection and Decision	10%
System Testing	10%
Risk Management	15%
Statistical Analysis	7%
Ethics	3%

The number of questions on the exam drawn from each knowledge domain approximates the percentages in the table above.

### Ethics

The CMT Association has adopted the CFA Institute Code of Ethics and Standards of Professional Conduct (“Code and Standards”) as its ethics guide. All three levels of the CMT exams include questions pertaining to ethics. All references to “CFA Institute,” “members,” “candidates,” “CFA Program,” and so on in the Code and Standards should be read to apply to CMT Association and its members, candidates, programs, and so on.

When preparing for the CMT exams, candidates are encouraged to review the Standards of Practice Handbook (“Handbook”). According to the CFA Institute, “The Standards of Practice Handbook grounds the concepts covered in the Code and Standards

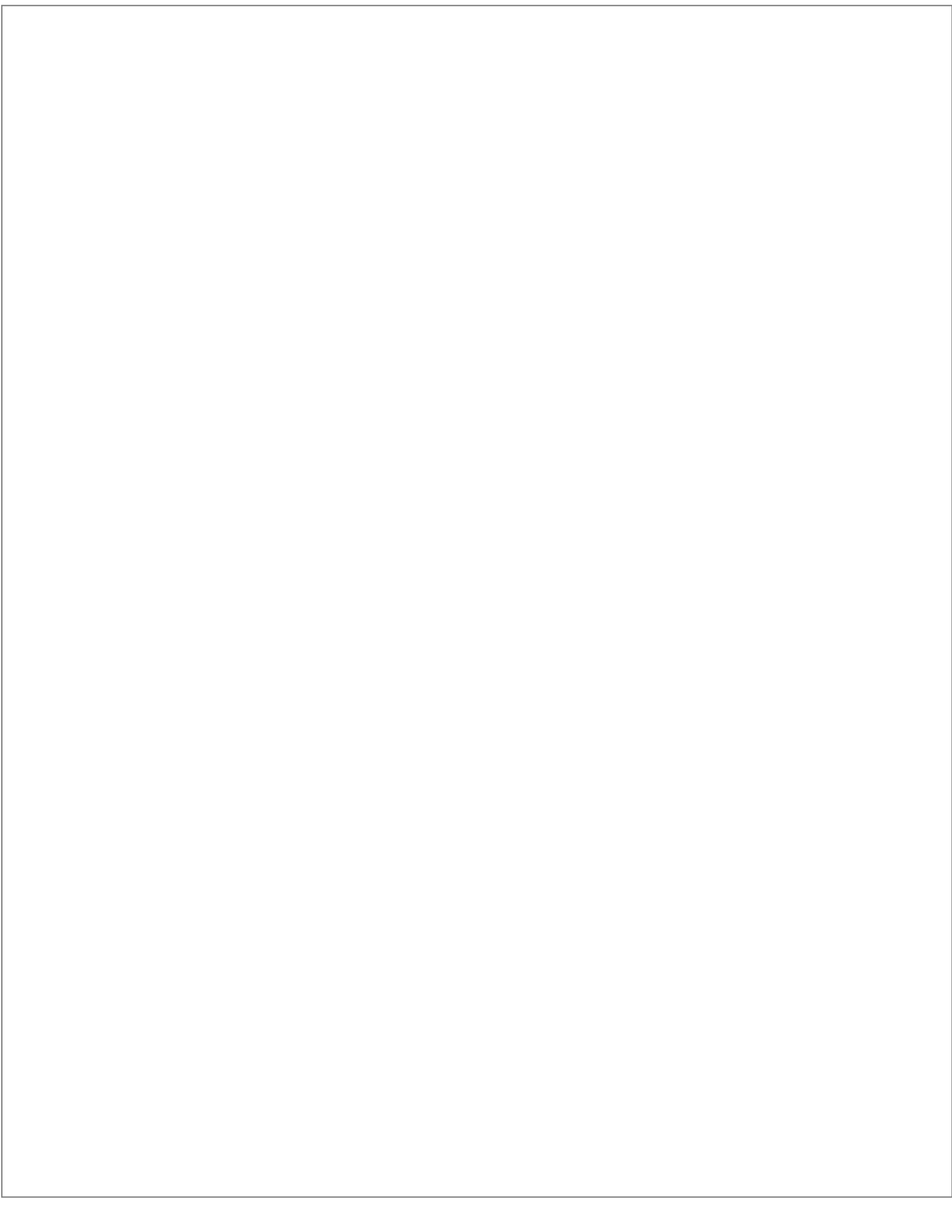
for practical use. You can use this handbook for guidance on how to navigate ethical dilemmas you might face in your daily professional life.” Reviewing the Handbook provides a more comprehensive study process and preparation for professional practice.

Study material regarding ethics is not in this text. Both the Code and Standards and the Handbook are available for download from the CMT Association website: <https://cmtassociation.org/association/cmt-code-of-ethics/>.

## **Learning Objective Statements**

A list of Learning Objectives appears at the beginning of each chapter. These are intended as a guide to the most important concepts discussed in the chapter. An effective study method is to read the Learning Objectives as an introduction to a chapter before beginning study of the chapter. After completing the chapter, review the Learning Objectives again and write a few sentences that demonstrate competence on that topic.

Candidates should also be aware that the specific points mentioned in the Learning Objectives are prime material for the exams, but there may also be questions drawn from any part of the text.



## THE ORIGINS OF THE TERM “TECHNICAL ANALYSIS”

By George A. Schade, Jr., CMT

The technical position of the market may warrant a continued reaction, but actual business conditions do not warrant lower prices.<sup>1</sup> *New-York Daily Tribune*, June 21, 1897.

A discussion among technical analysis professionals prompted the query, “Where did the term ‘technical analysis’ originate?” This commentary aims to trace the roots of the name of our craft.

In 1922, William Peter Hamilton, editor of the *Wall Street Journal*, had his influential Dow Theory book *The Stock Market Barometer* published.<sup>2</sup> In downplaying the importance of stock manipulators, he cited Edwin Lefèvre’s description of a manipulator featured in Lefevre’s fictional story *The Break in Turpentine*, published in April 1901:

The art [of manipulation] is most difficult, for stocks should be manipulated in such wise that they will not look manipulated. ... It requires boldness and consummate judgment, *knowledge of technical stock-market conditions*, infinite ingenuity and mental agility, ... (emphasis added).<sup>3</sup>

The reference to technical stock market conditions shows that the term “technical” was associated with stock market commentary as early as the dawn of the 20<sup>th</sup> century.

### ■ I. The Dictionaries

Our starting point is the definition of “technical.” In 1828, lexicographer Noah Webster published his two-volume *An American Dictionary of its English Language*. He worked on it from 1807 until 1824–25. The dictionary stated that the terms

“Technic, Technical” were Greek derivations “from art, artifice . . . to fabricate, make or prepare,”

Pertaining to art or the arts. A *technical* word is a word that belongs properly or exclusively to an art; as the verb to *smelt*, belongs to metallurgy. So we say, *technical* phrases, *technical* language. Every artificer has his *technical* terms.<sup>4</sup>

The dictionary stated that the term “analysis” was of Greek derivation, “a loosing, or resolving . . . to loosen,”

1. The separation of a compound body into its constituent parts; a resolving; as, an *analysis* of water, air or oil, to discover its elements.
2. A consideration of any thing in its separate parts; an examination of the different parts of a subject, each separately; as the words which compose a sentence, the notes of a tune, or the simple propositions which enter into an argument. It is opposed to *synthesis*.<sup>5</sup>

An 1865 revised edition of Webster’s 1828 dictionary defined “technical,” in relevant part as follows:

Specifically appropriate to any art, science, or business; as, the words of an indictment must be *technical*. *Blackstone . . . .*<sup>6</sup>

The 1865 edition defined “analysis” as:

A resolution of any thing, whether an object of the senses or of the intellect, into its constituent or original elements; an examination of the component parts of a subject, each separately, as the words which compose a sentence, the tones of a tune, or the simple propositions which enter into an argument. It is opposed to *synthesis*.

Up through 1916, dictionaries derived from Webster’s lexicography retained the same definition of “technical.” The term pertains “to the mechanical arts: relating to art, science, or to a particular profession.”<sup>7</sup>

The most frequently used legal dictionary in the United States, Black’s Law Dictionary, was first published in 1891. The 1910 edition defined the term “technical” as, “Belonging or peculiar to an art or profession. Technical terms are frequently called in the books ‘words of art.’”<sup>8</sup>

These influential early dictionaries show that “technical” was a term applicable to an art, science, business, or profession and “analysis” involved the separation and examination of the components or elements of a matter being studied.

By the mid-1890s, the term “technical” took on a unique meaning when it came to the stock market. The term was associated with a description of the condition or position of the stock market, particularly, to refer to an oversold or overbought market.

Although he did not use the term “technical,” Charles H. Dow editorialized in July 1902, “The outsider who will wisely study values and market conditions and then exercise patience enough for six men will be likely to make money in stocks.”<sup>9</sup> In his March 7, 1902 editorial, he wrote, “Intelligent trading begins with study of conditions, and a justified opinion that the general situation is either growing better or worse.”

In 1903, *Smith’s Financial Dictionary* was published. Smith did not define “analysis” or “technical analysis” but defined “technical conditions or a technical market” as follows:

Technical conditions exist in a stock when the price is raised by manipulation—by force of buying orders given and executed for the purpose; or such conditions exist when the price is lowered by manipulation—by force of selling orders given and executed for the purpose. Also, technical conditions exist in a stock when the price rises in consequence of enforced covering of short contracts (enforced buying by speculators who had sold stock which they did not possess) or such conditions exist when the price falls in consequence of enforced selling of long stock (stock which had been purchased with the intention of selling at an advanced figure.)

A technical market exists when prices as a whole are raised or lowered, as the case may be, by manipulation; also a technical market exists when an oversold condition compels covering of short contracts with a consequent rise in prices or when an overbought condition compels liquidation or sale of long stocks with a consequent fall in prices.<sup>10</sup>

Another financial dictionary, published in 1906, did not define “analysis,” but defined “technical conditions” in relevant part as follows:

When prices in a stock market as a whole are advanced or depressed by manipulation. The technical conditions in an oversold market cause an advance which forces short covering, and the technical condition in an overbought market result[s] in liquidation of long stock in consequence of a fall in prices.<sup>11</sup>

In 1918, the Investment Bankers Association of America and the Association of Stock Exchange Firms published a study course of the “stock exchange business.” The course defined the “technical condition of the market” in relevant part as follows:

Reference is constantly made in the press to the “over-bought” or “over-sold” condition of the market. By these terms it is meant that there has been, in view of the normal supply and demand of a given security, an unusually large amount of buying on margin or an unusually large amount of short selling. If this over-bought or over-sold condition is discovered, the opposing interest in the market may seek to compel a decline, or to compel the short interest to cover.<sup>12</sup>

Sereno S. Pratt was a career journalist from 1882 until he became editor of the *Wall Street Journal* in 1905. Hailed as one of the brightest financial writers among New York City’s journalists, he wrote a comprehensive book that described the stock market and its trading practices. The following definition of “technical position” appeared in the 1912 edition:

[T]he stock speculator must study the stock-market itself so as to inform himself as fully as he can as to its condition: whether there is an over-supply of stocks on hand ready to be sold, or a big short interest; what certain influential “interests” or heavy operators are doing; whether the supply of money for speculative purpose is, or is not, to be ample; in other words the whole technical position of the market.<sup>13</sup>

The word “technical” became part of Wall Street’s language to describe the condition of the stock market as overbought or oversold. Initially, these conditions were attributed to stock manipulation raising the question whether the term “technical” was used to describe an artificial condition due to manipulation.

## ■ II. The Newspapers

By 1897, the term “technical” was being used in newspaper columns reporting on the stock market. Newspapers formalized the use of the term to describe daily stock trading activities. Their reports strongly influenced the acceptance of the term “technical” into the vernacular of Wall Street.

Following are some of the earliest references found in New York City newspapers of general circulation:<sup>14</sup>

June 21, 1897—“The technical position of the market may warrant a continued reaction, but actual business conditions do not warrant lower prices.” *New-York Daily Tribune*.

November 5, 1897—“Outside buying on a small scale was noticed on all declines, but it was not effective in preventing substantial net losses, although it strengthened the technical position of the market.” *New-York Daily Tribune*.

November 8, 1897—“The market will soon be oversold—just as it was overbought last summer—and when that condition appears advances will be made, despite any adverse factors which may then exist. The weakness last week materially strengthened the market. Its technical position was improved by the passing of stocks from weak to strong hands and by the creation of a large short interest.” *New-York Daily Tribune*.

December 4, 1899—“The greater part of the supply of stock available for speculative purposes is strongly held, and there is no disposition

among such holders to sell at ruling prices. Back of the strong technical position is the business situation, which is constantly adding increased value to the intrinsic worth of securities.” *New-York Daily Tribune*.

December 31, 1899—“Prosperity has placed a healthful check upon rash speculative ventures, and the new year therefore opens with the speculative situation clear of weak material, with the banks and stock market in a strong technical position backed by active and sound business conditions.” *New-York Daily Tribune*.

January 14, 1900—“The technical position of the market is strong, and in the current week the force of this strength ought to be felt by the operators who are short of stocks.” *New-York Daily Tribune*.

July 7, 1900—“Traders are, for the time, bullish but they will begin to bear stocks again just as soon as technical conditions place stocks in a position where they may be successfully attacked.” *New-York Daily Tribune*.

May 4, 1901—“They represent the operations of oversanguine traders who can see but one side of affairs—who overlook the always potent ‘technical position’ and who imagine that a rise can be unbrokenly continuous.” *New York Times*.

July 27, 1902—“Technical conditions moneywise have been and are favorable.... An important phase of the technical situation is the paucity of holdings ‘on margin.’” *New York Times*.

May 5, 1905—“Nor could cause for the fall in prices be ascertained from any analysis of the technical speculative position in Wall Street at the present time.” *The Sun*.

August 10, 1917—“A technical analysis of the decline on Wednesday in the final hour shows that it was a mere bear raid and was not backed up by any genuine liquidation.” *The Sun*.

May 10, 1918—“With no more news than has been known for some time past to explain the sharp advance of security prices yesterday traders turned to the technical conditions within the market itself for enlightenment. ... And yet an analysis of the market’s technical situation, referring mainly to money and the short interest, do not greatly illuminate the onlooker.” *The Sun*.

### ■ III. Charles H. Dow’s Editorials

Charles H. Dow’s principles set forth in his *Wall Street Journal* editorials were seminal contributions to the discipline of technical analysis. He wrote eight editorials, out of some 255, entitled *The Position of the Market*. These editorials were written between March 19, 1901 and April 22, 1902. He wrote his last editorial that April. Although the eight editorials did not use the terms “technical” or “technical analysis,” as noted above, Dow knew the importance of assessing market conditions.



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THE ORIGINS OF THE TERM "TECHNICAL ANALYSIS"

## ■ IV. Technological Advancements

The period from 1870 to 1914 is called the Second Industrial Revolution or the Technological Revolution because of the transformative inventions of the time. Four inventions brought accuracy with speed to financial markets: the telegraph, cable, the telephone, and the “stock indicator” later called the ticker. Stock quotations and market information sped worldwide. Even the nascent Dow Jones & Company News Service was distributed via telegraph.

In 1866, a reliable telegraph cable line crossed the Atlantic from the United States to Europe connecting the two largest financial markets in the world, London and New York. Cable expanded the reach of Wall Street’s institutions which began to underwrite foreign bonds and trade securities worldwide.

By 1912, there were 408,769 telephones in New York City; it was estimated that “there are probably a greater number in the Wall Street district than in any other equal territory in the world.”<sup>16</sup> About 500 members of the New York Stock Exchange (NYSE) had private connections to the exchange’s trading floor.

In 1867, telegrapher Edward A. Callahan introduced the stock ticker. The ticker printed quotations on a narrow ribbon of paper that became known as the “tape.” In 1905, some 23,000 offices in the United States subscribed to ticker services. By 1912, the NYSE was using 1,150 tickers to supply quotations to its 1,100 members in 583 firms.<sup>17</sup> “No better proof is needed of the universality of speculation.”<sup>18</sup>

The introduction of the ticker “revolutionized market communications by making it possible to quickly transmit market information across the United States, significantly narrowing the gap between Wall Street and Main Street. When telephones were installed at the NYSE in 1878, the market became even more efficient, and on December 15, 1886, trading volume topped 1 million shares for the first time.”<sup>19</sup>

These tools resulted in faster distribution of accurate market data and increased securities trading. Technical studies had a bright future.

## ■ V. The Growth of Stock Trading in the United States

In 1818, the newly formed New York Stock and Exchange Board listed less than fifty different issues. In 1839, it listed 144 stocks. The “number and variety of securities traded at the NYSE steadily increased as America grew. States and municipalities issued bonds to finance the construction of turnpikes, canals, and bridges. Banks, insurance companies and railroads issued stock to raise the necessary capital to develop and expand. By the end of the Civil War, more than 300 different stocks and bonds were traded at the NYSE.”<sup>20</sup> In 1869, the NYSE had 1,060 members.

The listings of stocks and bonds grew through the 1880s as the economy expanded. Between 1875 and 1885, the number of shares traded on the NYSE doubled. In 1882, over 116 million shares traded.

Increased trading produced large quantities of information which, in turn, stimulated a desire for a new form of investment analysis.



NYSE Trading Floor, 1903.<sup>21</sup>

## ■ VI. Creation of the Dow Jones Industrial and Railroad Averages

On July 3, 1884, Charles H. Dow published his first stock price average when he was working for the *Customer's Afternoon Letter*, a financial news bulletin. The average consisted of the closing prices of 11 companies, of which 9 were railroads. It was the forerunner of the Dow Jones Railroad Average.

From 1884 to 1896, Dow made changes to the index, mostly switching from railroad to industrial stocks. On May 26, 1896, he introduced the price-weighted Dow Jones Industrial Average, consisting of twelve industrial stocks. In 1916, the average was expanded to 16 stocks, and in 1928, to 30. The average was proof that industrial stocks were overtaking the railroads as the leading stocks in the NYSE.

On October 7, 1896, Dow introduced the Railroad Average. He replaced the two non-rail stocks in his list of 20 “active stocks” with rail stocks, and the Dow Jones Railroad Average was created. In 1970, its name was changed to the Dow Jones Transportation Average.

Charts of the averages showed price trends and facilitated analysis of market conditions. These averages, as well as the numerous other indexes that came after, added an important dimension to the analysis of price, volume, and performance, the core of technical analysis.

## ■ VII. The Twenties

The concept of the technical condition or position of the stock market as being overbought or oversold remained into the 1920s, a significant formative period for technical analysis. Professors Solomon S. Huebner and Charles A. Dice each wrote influential books about the stock market, both entitled *The Stock Market*. They defined “technical position of the market” as describing an overbought or oversold market.<sup>22</sup> Dice wrote a chapter entitled *The Technical Position of the Market*.

By the late 1920s, the term “technical analysis” was used frequently. Richard W. Schabacker wrote about the two kinds of analysis, fundamental and technical. The “technical considerations are those arising out of the stock market itself.”<sup>23</sup> He wrote about the “technical approach,” “technical theory,” “technical science,” and “technical action.” His 1932 investment course was entitled *Technical Analysis and Market Profits: A Course in Forecasting*.<sup>24</sup>

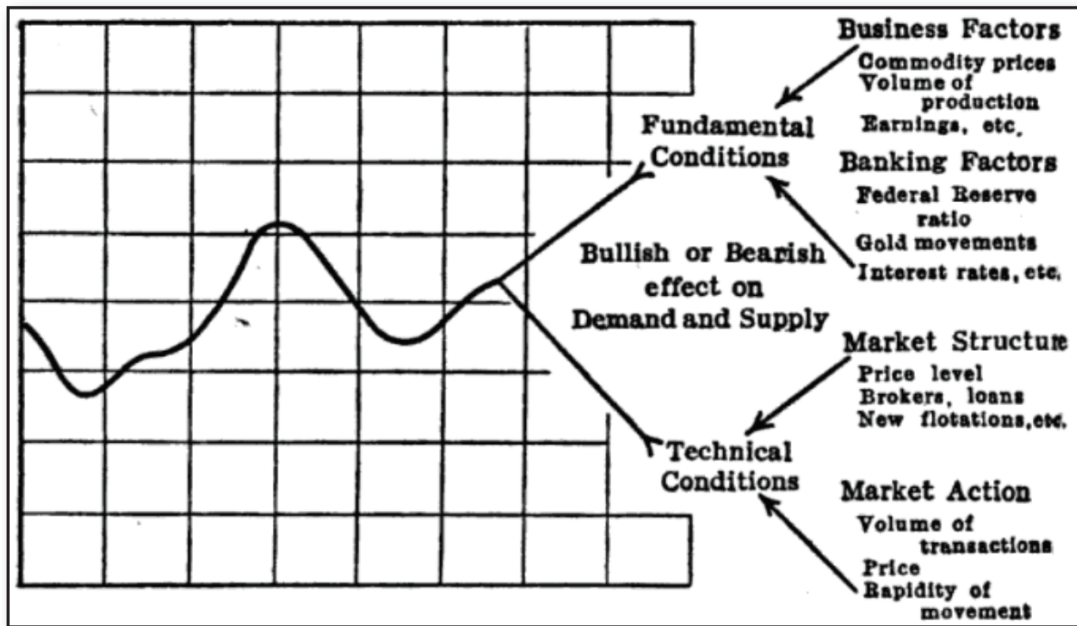
The elements of the discipline were being set. In 1931, Joseph H. Kerr, Jr. described the principal “factors of deduction,” which when combined with technical conditions, could forecast the action of the market: Price, Volume, News, Price Position, and Time.<sup>25</sup> Analyst Harold M. Gartley shortened the list to price, volume, and time.<sup>26</sup>

Twelve years earlier, a statistician wrote with great concision:

When demand and supply are fairly even, the market moves in a rut.  
How secure a clear-cut idea of demand and supply? By constructing a graph which shows:

1. Price. This measures the *extent* of the move.
2. Time. This shows *rapidity* of action.
3. Volume. This indicates *bulk*, or the amount of turnover. (emphasis in original)<sup>27</sup>

This statistician drew the following graph:



### Making the Market Price

By 1930, the study of stock market trends, prices, volume, and performance had received a great amount of attention. The foundations of technical analysis had been built.

## ■ Conclusion

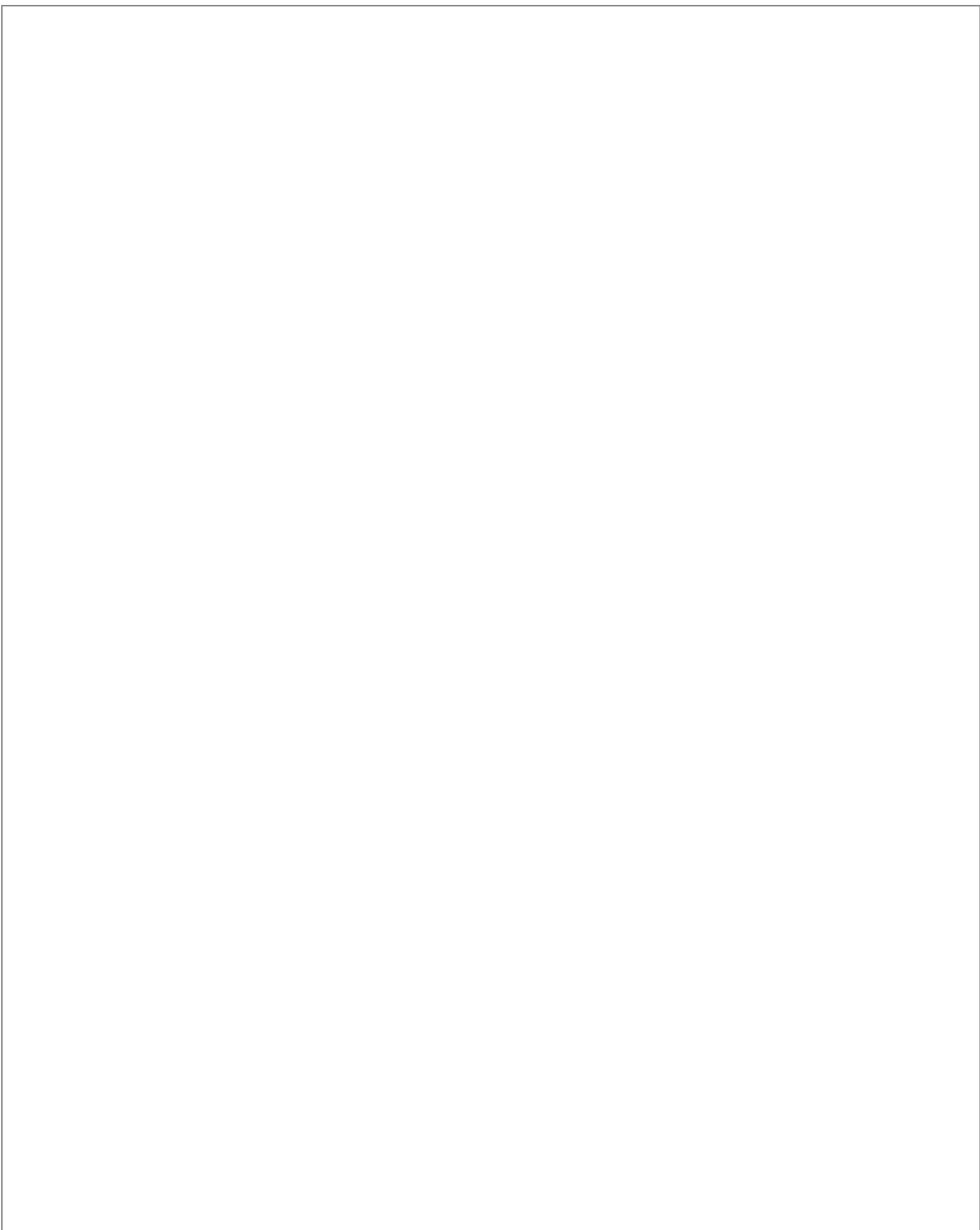
The lexicography of the term “technical” relates it to an art, science, business, or profession. The term “analysis” refers to the separation of a whole into its constituent elements so they can be studied. The stock market can be overbought or oversold. In the late 1890s, the term “technical” was used to describe this condition.

As stock trading increased at the advent of the 20th century, aided by inventions that brought accuracy and speed to the process, significant amounts of information were collected and distributed. Price, volume, performance, highs, and lows were immediately available. This information was analyzed in order to uncover values. Technical analysis became both a discipline and a profession.

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SECTION I

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# CHART DEVELOPMENT AND ANALYSIS

*The goal is to turn data into information, and information into insight.*

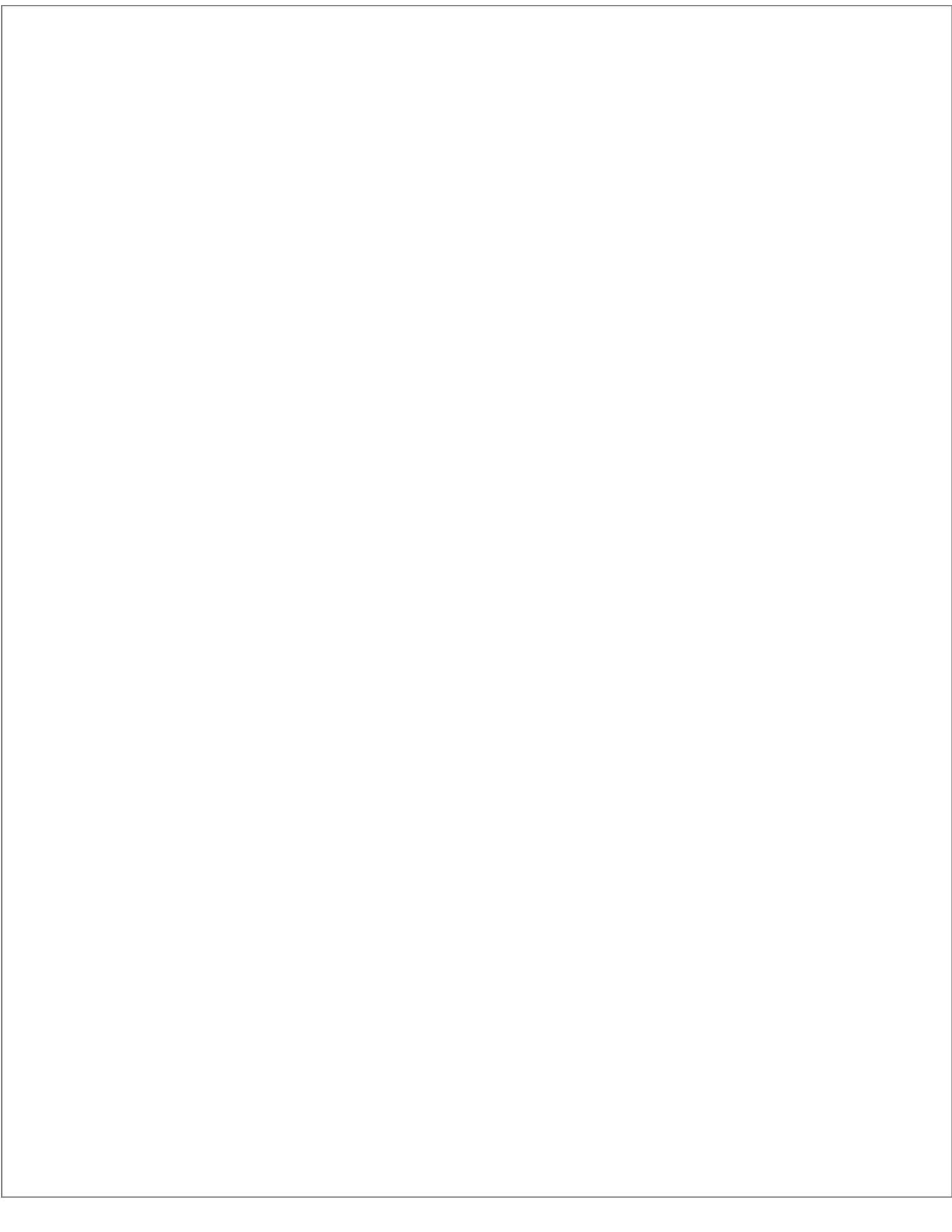
—Carly Fiorina

For centuries, technical analysts have worked to better organize, visualize, categorize, and capitalize on the data provided by freely traded markets. The four data points traditionally used to benchmark each trading interval—open, high, low, and close—may be represented in a variety of forms, all in search of more useful interpretation. Single and multiple data points, groupings of multiple data points, and measures of activity including volume and open interest provide the raw material for charts and for a growing number of indicators.

This section presents a discussion of methods of charting prices and associated data that bridge the gulf between traditional technical analysis and applications in modern financial markets, including extended coverage of momentum and breadth.

In keeping with this theme, this section also presents concepts and tools related to the analysis of cycles in price action. This can be a challenging topic that requires the analyst to see prices from a different perspective, outside conventional trend analysis.

All these subjects are essential to the work of the technical analyst, whether they are applied in a subjective context or used as the theoretical underpinnings of rules-based systems.



# Charts: Understanding Data Intervals

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## Learning Objective Statements

- Employ a sequence of multiple data intervals to identify trends.
- Compare the typical construction of weekly and monthly interval charts.
- Review challenges related to consistent data sampling using time-based intraday intervals.
- Interpret general trend relationships in charts with multiple price-data sets.
- Interpret the significance of the data points in a scatter plot.

At its root, technical analysis is the study of price. Because price captures all the information about the supply and demand for a security, monitoring price behavior allows analysts to detect movements in supply and demand. Charts are tools for gathering and recording that information so that it can be used for analysis. How to gather and organize the price information varies, depending on the type of analysis analysts want to conduct, the data elements deemed critical to that analysis, and the trading or investment horizon.

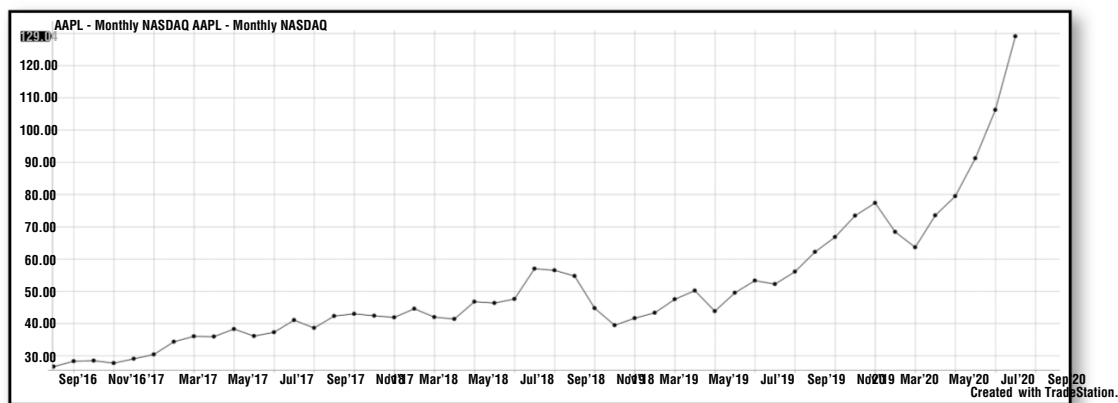
## ■ Data Intervals

First, we consider how frequently analysts want to gather data. Suppose you want to analyze the price behavior of Apple, Inc. (AAPL). With almost 200 million shares of AAPL trading each day, it would be impractical for most analysts to track every single observed price. With millions of observations in a day, you would become distracted by many small price moves that do not help determine the overall price trend. These price moves that occur around the underlying trend are often called *noise*. Trying to capture every price observation rather than the general price movements would be akin to missing the forest for the trees.

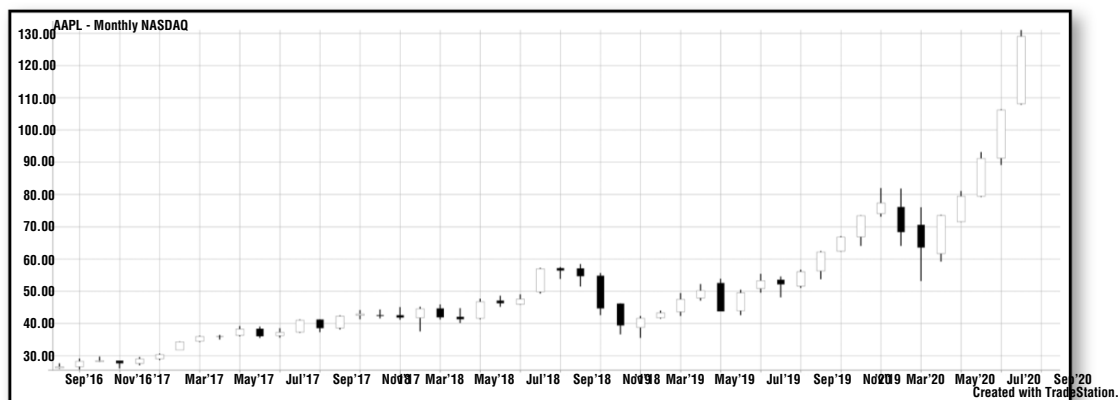
Often analysts use a sampling technique to gather a small set of data that is representative of the broader, larger population. This method reduces data collection time and expense and helps users avoid being distracted by the noise in the data. A line chart of monthly closing prices is an example of sampling. One observation, the closing price of the stock on the last trading day of the calendar month, is collected to summarize the millions of prices that occurred during the month. Figure 1.1 is a chart of AAPL from August 2016 to August 2020 with monthly sampling, commonly known as a monthly chart. Each dot on the chart represents one price observation that is used to summarize the price data for the month. These dots are then connected to form a line chart.

In a monthly line chart, 12 data observations are used to summarize the price behavior during an entire year. A bit more information can be portrayed in a monthly candlestick chart, such as the one in Figure 1.2. Each candlestick in the chart represents one month of trading from August 2016 to August 2020. The sampling period is still one month, but now four pieces of information are sampled each month: the first price of the month (open), the last price of the month (close), the highest price that occurred during the month (high), and the lowest price that occurred during the month (low).

Glancing at Figure 1.1 or Figure 1.2, you can tell that AAPL has been in an uptrend. Figure 1.2 adds information regarding the range of price that occurred each month. You see five open-bodied candlesticks for April through August of 2020, indicating that AAPL ended each of those months at a higher price than it began the month. These five candlesticks have very short wicks; this gives you even more insight



**FIGURE 1.1** Monthly Line Chart, AAPL, August 2016–August 2020



**FIGURE 1.2** AAPL Monthly Candlestick Chart August 2016–August 2020

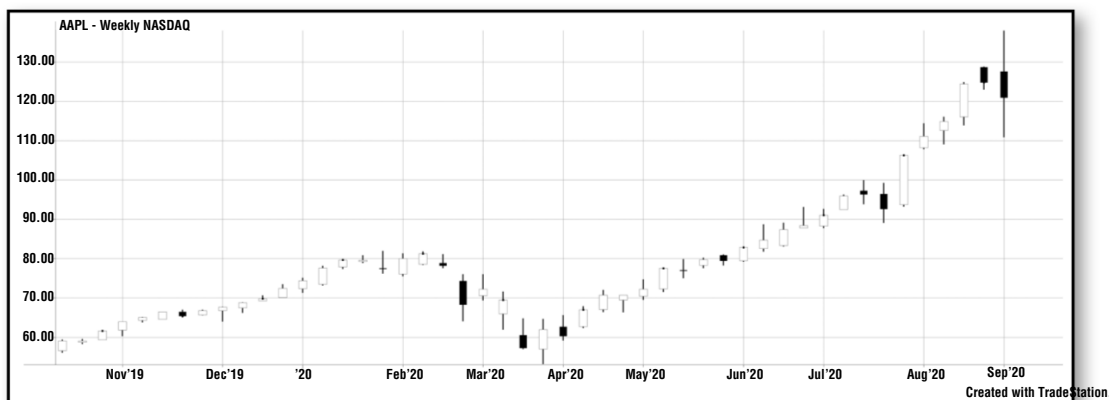
into the price behavior: The stock did not move much lower during the month than where it opened, and it finished the month near or at its highest price in the month. Also, you notice that the bottom of each month's candlestick occurs at approximately the same price level as the top of the previous month's candlestick. This suggests a steady march upward in price during the five months. Price is increasing throughout the month, and that price movement continues into the following month.

If you purchased AAPL during the last several years, you entered favorably, during a general uptrend. But the entry is only half the story of what makes a good trade. You must also make a good exit decision. You want to exit this position when the long-term uptrend ends. It is now early September; you have achieved gains and do not want to remain in the position if the uptrend has stalled or reversed.

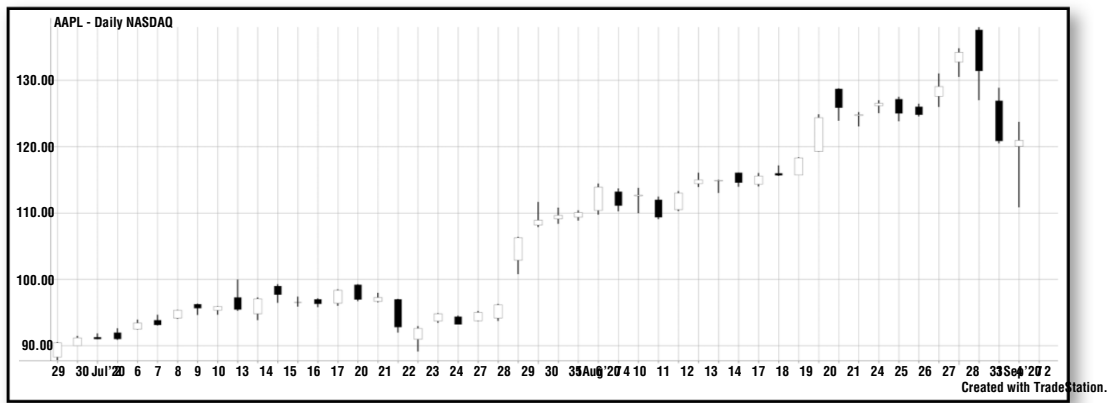
Charts in which a single bar depicts a long period of trading, such as a month, are good at showing long-term trends; they factor out much of the daily noise in the data. However, they are slow to show changes in trend. Technical analysts rely on analysis in multiple time frames, or "data intervals" in charting terms, to get clues about changes in trend.

A weekly chart of AAPL, as shown in Figure 1.3, shows the price progression over the previous few months in more detail. We see, for example, that much of the price increase in July came in the last week of that month. We also see that AAPL has ended each of the last two weeks lower than where it started. Furthermore, we see that the candlestick for the first week in September has extremely long top and bottom shadows. Seeing the price behavior over the past couple of weeks, you are becoming concerned that the uptrend has run its course. You might use an additional time frame (data interval), a daily candlestick chart, such as that in Figure 1.4.

The last five candles in Figure 1.4 decompose the price movement of the last candle in Figure 1.3 into daily price moves. You knew from the last candle in Figure 1.3 that AAPL began the week at about \$127 per share, ended the week about \$121 per share, but sold for a price as high as about \$137 and as low as about \$111. Looking at the daily chart in Figure 1.4, you can see more of the progression of price during the week. You see that on Monday and Tuesday the price of AAPL went up and that price appreciation continued into the open on Wednesday. You also see that the high of the week occurred near the Wednesday opening price. That price behavior changed, however, during the day on Wednesday, with the price falling



**FIGURE 1.3** AAPL Weekly Candlestick Chart



**FIGURE 1.4** AAPL Daily Candlestick Chart

to approximately Monday’s opening price and then rebounding a bit to close near Tuesday’s low price. On Thursday, the stock opened at approximately the low of the previous day and was not able to hold on to price appreciation, finishing near the low of the day. The closing price on Thursday was at a level that had not been seen since August 21. On Friday, despite an intraday price swing of about 10%, AAPL ended the day almost unchanged from the previous day.

Now you know that the top of the upper shadow on the weekly candle pictured in Figure 1.3 occurred because of price increases that happened early in the week. These price increases were not sustained, however, with price falling and testing a support zone around \$110 on Friday, a level that had been established in early August.

**BOX 1.1**

Although modern software allows for custom treatments of weekly and monthly charts, the standard construction methods use calendar weeks and calendar months. That is, a weekly chart includes data for the five trading days of the calendar week:

- The opening price of the first trading day of the week (typically Monday, but could be Sunday evening; this depends on the market and time zone),
- The highest and lowest prices of the entire calendar week,
- The closing price from the last trading day of the week (typically Friday).

During a week that includes holidays, the data is drawn from the remaining trading days in the calendar week.

A monthly chart includes data for all the trading days of the calendar month, regardless of how many trading days there are in the month:

- The opening price of the first trading day of the month
- The highest and lowest prices of the entire calendar month
- The closing price from the last trading day of the month

During a month that includes holidays, the data is drawn from the remaining trading days in the calendar month.

An important effect of this is that weekly and monthly charts rarely open or close with the same daily data. In fact, they typically open or close with the same daily data *only* when the first or last trading days of the month fall on a Monday or a Friday, respectively.

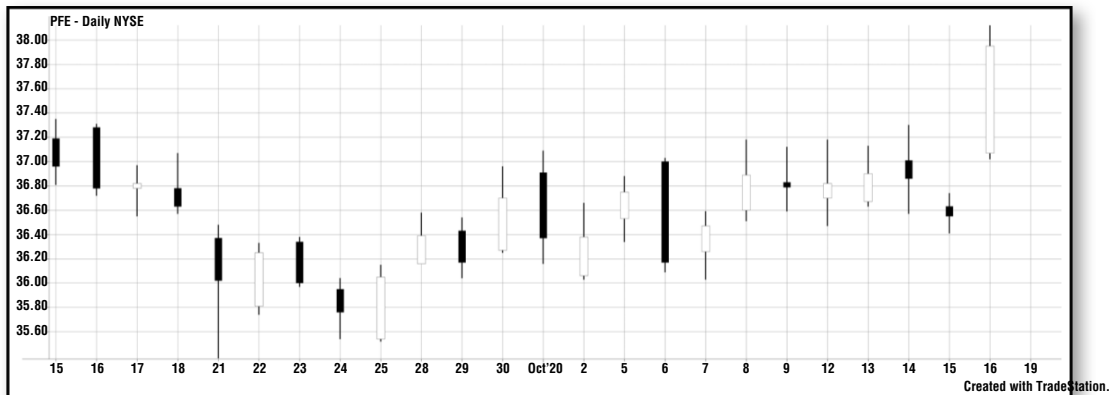
## ■ Working with Multiple Data Intervals

Using multiple time frames allows analysts to determine a longer trend and then zero in on the most recent price behavior. This is done by using a chart constructed with longer data intervals, such as the monthly chart in Figure 1.2, and then moving to charts with shorter intervals for the more recent time period, as in Figures 1.3 and 1.4. For longer-term investors, reasonable time frames would be charts created using one-month, one-week, and one-day data intervals. A general rule of thumb is that the data interval for the next shorter time frame should be no more than one-quarter of the previous data interval. In the example we just looked at, we started with a monthly data interval and then used a weekly data interval, which is approximately one-quarter of the monthly interval. Then the next interval used was a daily chart, which is generally one-fifth of the weekly interval.

This general process can be used by long-term investors or short-term traders. Technical analysts would progress from longer data intervals to shorter intervals, but the lengths of those intervals would change depending on the investing or trading horizon. Investors who are making portfolio adjustments once per week, for example, would not be interested in any chart constructed with an interval smaller than daily; those investors are interested in longer-term trends, and intraday price movements are simply noise around those trends. For day traders, however, intraday data intervals are important.

For example, suppose you are a trader who has been asked to fill a buy order for 100,000 shares of Pfizer, Inc. (PFE) on October 19, 2020. You are not using the chart to decide whether PFE is a stock you want to purchase (or sell); your one objective is to buy 100,000 shares today at the lowest cost possible. You might begin with a recent daily candlestick chart for PFE, such as in Figure 1.5. This daily chart will give you an idea of any recent trends, support levels, and resistance levels that have developed for PFE.

The tall candle for the latest trading day shows upward price movement. A resistance zone had been in place around 37 for the past couple of weeks. The trading activity on Friday was above that resistance zone, suggesting a breakout. The open body of Friday's candle shows that PFE closed higher than it opened. In addition, the short lower wick indicates that PFE opened near the low of the day, and the short upper wick indicates PFE closed near the high of the day. You are curious, however, if the upward price move occurred throughout the day or if it was more pronounced



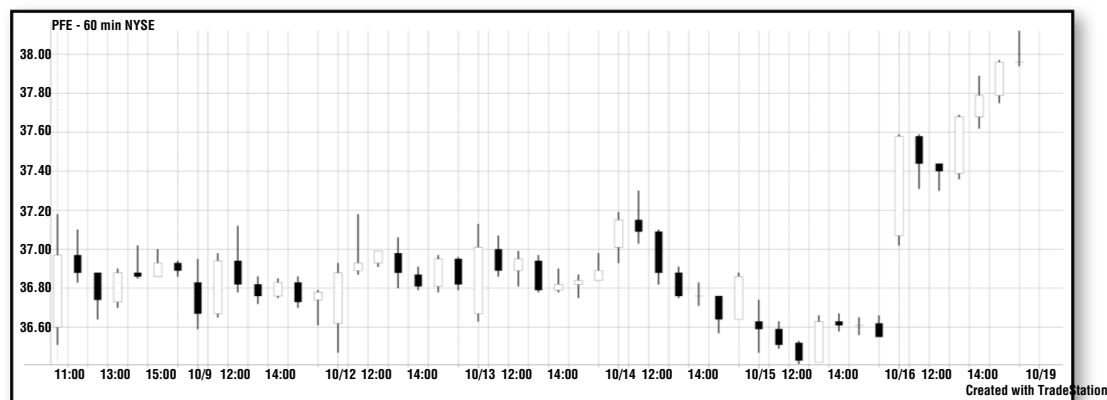
**FIGURE 1.5** PFE Daily Candlestick Chart

in the morning or late in the trading day. In order to decompose Friday's price gain, you turn to a candlestick chart of a shorter interval, perhaps an hourly chart.

Figure 1.6 contains an hourly candlestick chart for PFE. Now you can see that PFE opened strong, rising during the first hour of trading. PFE trended strongly higher during the day, despite a bit of a stall during the second two hours of trading.

You know that you are entering Monday morning with an order to purchase 100,000 shares of PFE. You are especially interested in looking to see if the upward trend will continue through Monday; if so, you want to purchase your shares as early in the day as possible. Now that you have gleaned information from the daily and hourly charts, you will move to an even shorter interval to place your orders. Perhaps you would consider a 10-minute chart and then a 1-minute chart.

The particular sequence you will want to follow depends on several factors. Analysts who are trading stocks with high volatility and high daily volume tend to use shorter intervals than analysts who are trading less-volatile and lower-volume stocks. Those who have access to high-speed data and fast order execution use shorter intervals than individuals who lack that access. The relevant analysis sequence of data intervals also depends on the nature of the trader, with longer-term investors not being concerned with intraday time frames. But the rule of starting at a longer interval and working down to shorter intervals, with each subsequent interval being no more than one-quarter of the longer interval, holds for all investors.



**FIGURE 1.6** PFE—60-Minute Candlestick Chart

#### BOX 1.2

A peculiarity of hourly charts is that, generally, each candle or bar represents price behavior over a particular, consistent time period, such as a week, a day, 15 minutes, or one minute. The trading day for U.S. stock markets begins at 9:30 a.m. and ends at 4:00 p.m. Eastern time, meaning that the market is open for 6½ hours, or 390 minutes. Charting programs plot seven hourly bars or candles for a typical trading day. The first bar or candle plots price behavior from 9:30 a.m. to 10:30 a.m., or the first 60 minutes of trading. The second bar or candle maps price behavior for the second hour, beginning at 10:30 a.m. and representing the second 60 minutes of trading. This process continues throughout the trading day with the seventh candle capturing price behavior for minutes 361 to 390 of the trading day, or the last 30 minutes.

The inference to be drawn is that not every 60-minute bar is equal. Analysts using intraday time intervals often consider the length of the trading day and how it is divided by the intervals they select.

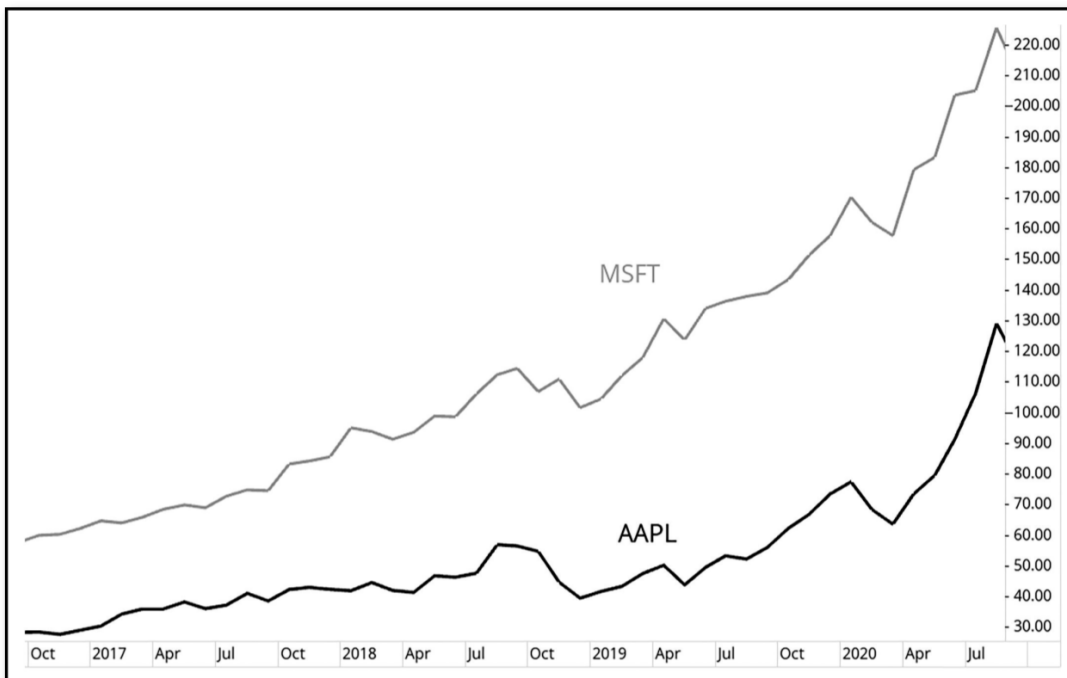
## ■ Charting Multiple Data Sets

The charts we have considered so far portray a single security. They are helpful in determining the trend for a particular stock. At times, however, we want to compare two securities. Figure 1.7 displays a chart that provides price information for AAPL and Microsoft Corp. (MSFT). This chart provides time-series data, collected at a monthly interval, for each of these two companies. Time is measured on the horizontal axis. The prices of the stocks are noted on the vertical axis.

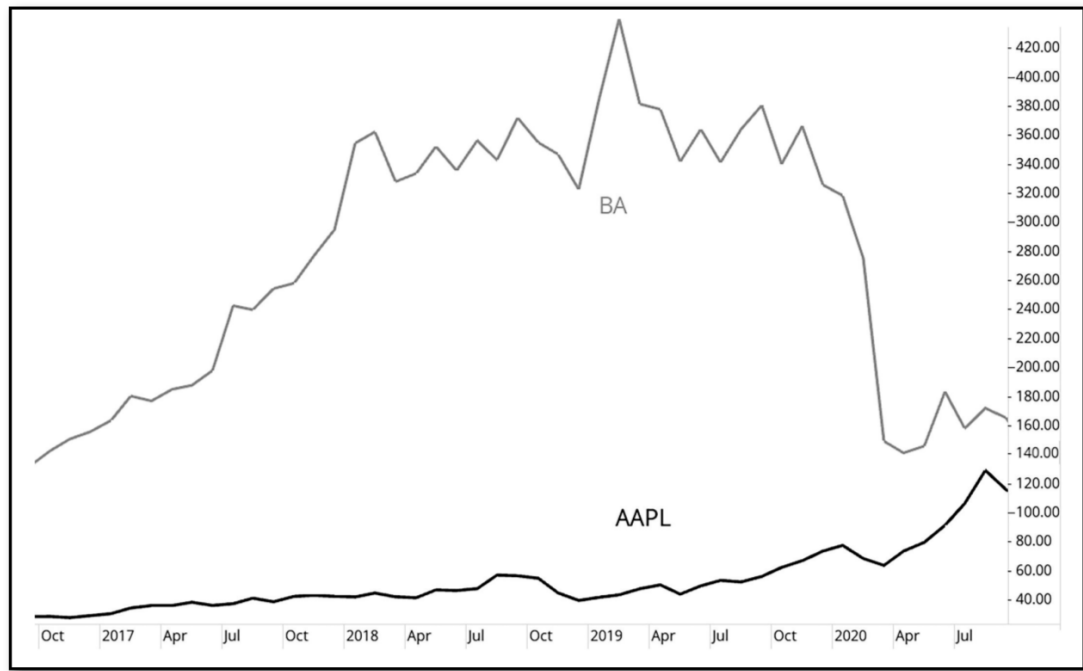
Both MSFT and AAPL have been in an uptrend. The presentation of the data in Figure 1.7 allows analysts to begin considering if the uptrend of one of the stocks is stronger than the other, or how one stock has performed relative to the other. Analysts can also begin to detect if the two stocks tend to increase and decrease in price at the same times, indicating how correlated the stocks are. (Details on how technical analysts calculate and apply correlation and regression analysis follow later in this text and in Level III.)

Figure 1.8 provides a visual comparison of AAPL with another stock, Boeing Co. (BA). Unlike MSFT and AAPL, which had similar-looking line charts, the line charts of AAPL and BA look different. The increase in BA during the first couple of years in the graph indicates that while both stocks were increasing in value, BA's uptrend was relatively stronger than that of AAPL. The last year of the chart shows AAPL in an uptrend while BA has been in a downtrend.

When the line plots of two stocks are fairly parallel, as in Figure 1.7, the two stocks are highly correlated. If the line chart of one stock rises more steeply than that of the other stock, then the former stock has a relatively stronger trend than the latter. When the line charts have different shapes, such as in Figure 1.8, then the correlation between the two stocks is very low.

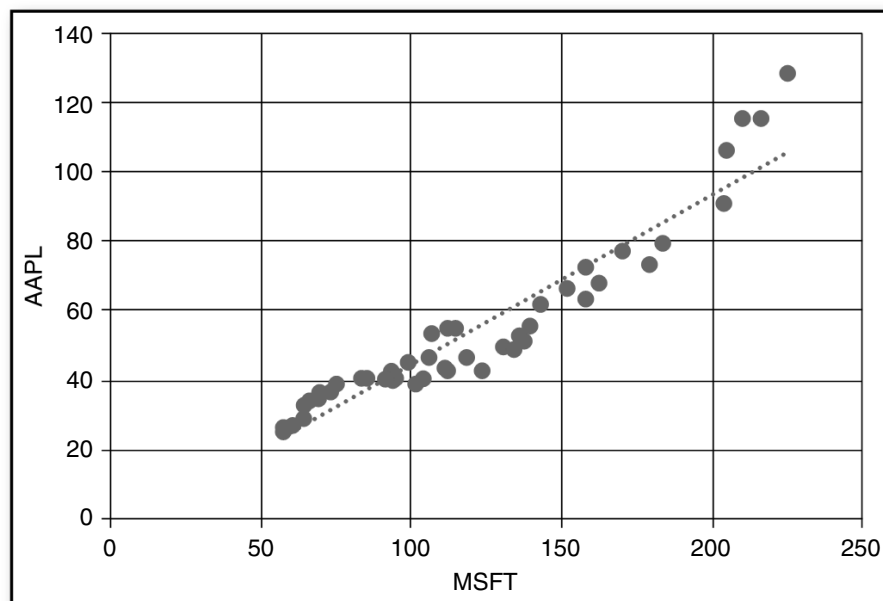


**FIGURE 1.7** MSFT (lighter line) and AAPL (darker line) Monthly Line Chart

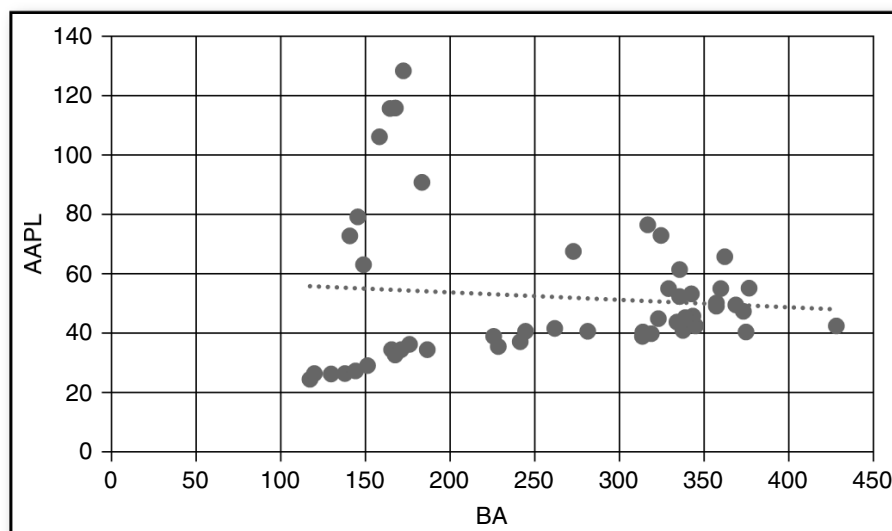


**FIGURE 1.8** BA (lighter line) and AAPL (darker line) Monthly Chart

Often line charts created through time-series data give insight into correlation between two securities and the relative strength of one of the stocks. Statistically, placing the same price data in a chart with the format of Figure 1.9 is done to highlight correlations. This scatterplot graph records the price of MSFT on the horizontal axis and the price of AAPL on the vertical axis. Each dot on the graph represents the combination of the two prices for one particular month. For example, the dot on the upper right-hand corner in the figure indicates that in the month that MSFT's stock price was 224.99,



**FIGURE 1.9** Scatterplot of MSFT and AAPL



**FIGURE 1.10** Scatterplot of BA and AAPL

and AAPL's stock price was 128.81. You cannot tell from the graph, however, when that price combination occurred, only that those two prices occurred simultaneously.

Another scatterplot graph is shown in Figure 1.10, with the price of BA, rather than MSFT, placed on the horizontal axis. This scatterplot looks substantially different from that in Figure 1.9. In Figure 1.9, the dots clustered around low prices for both AAPL and MSFT and high prices for both AAPL and MSFT; a best-fit line, which provided a reasonable representation of the pattern of the dots, could be drawn through the dots. In Figure 1.10, there is a wide range of prices for AAPL when BA is at a low price. Some months when BA traded around 175, AAPL had a price of only about 30, but at other times AAPL had a price close to 120. Likewise, BA sometimes traded for a low price and other times at a high price during months when AAPL traded at 40 per share. In Figure 1.10, it is difficult to draw a line that portrays a relationship between the two stocks.

## ■ Conclusion

In this chapter, we have looked at the choice of data interval in chart construction. Most commonly, technical analysts construct a chart by gathering and summarizing price data at a particular time interval, whether it is monthly, daily, for each minute, or some other frequency. This allows technical analysts to study price movement over time, whether long-term trends or intraday price movements are of interest. In the next chapter, we consider ways other than time to sample and present price data in a chart.

# Additional Charting Methods

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of Business, Texas Christian University

## Learning Objective Statements

- Describe the construction of the types of charts in this chapter.
- Compare the axes and intervals of these charts.
- Analyze trends and price action using these charts.
- Demonstrate how point-and-figure charts help minimize “noise.”
- Distinguish between charts with defined and undefined x-axes.
- State the basic principles behind Market Profile.

Most often, technical analysts gather price data at particular, consistent time intervals and plot this data on a chart, as we considered in the last chapter. However, there are instances in which analysts want to collect and present price data in other ways. In this chapter, we focus on some of these alternatives to plotting time on the x-axis and to using any defined x-axis at all.

## ■ Price-Based Intervals

### Point-and-Figure Charts

Although the origin of point-and-figure charting is unknown, it has been in use at least since the late nineteenth century. The point-and-figure charting method focuses solely on plotting price changes. Point-and-figure charts are plotted on grid paper. Each square on the graph paper is referred to as a “box.” As with other charting methods, price is plotted vertically on the point-and-figure chart. In Figure 2.1, the vertical boxes are labeled in \$1, or one point, increments.

The term “box size” is used to describe the price *increment* that is used on the vertical axis. The box size determines the minimum price movement that must occur for it to be plotted; price movements less than the box size are ignored.

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66					X				
65					X	O			
64					X	O			
63	X		X		X	O	X		
62	X	O	X	O	X	O	X		
61	X	O	X	O	X	O	X		
60	X	O		O	X	O	X		
59	X			O	X	O	X		
58	X			O	X	O			
57	X			O	X				
56	X			O	X				
55	X			O	X				
54	X			O					
53	X								
52	X								
51	X								
50									

**FIGURE 2.1 One-Point Three-Box Reversal (1x3) Point-and-Figure Chart Example**

For example, the last column of Xs in Figure 2.1 plots an increase in price with the highest box marked in that column at 63.00. If you observe prices of 63.90, 63.75, 63.22, and 63.97, you will not add a mark to the chart. You would not place an X in the next higher box until the price increases to or above 64.00.

Thus, you are not plotting a series of price observations at equal time intervals in the point-and-figure chart. You may observe one, five, 60 or any number of price observations before the price touches, or passes through, 64.00; none of those price observations are plotted on the chart. This also means that there is no specific time interval that will pass before another X is marked in the chart.

The box size can be expanded by labeling the boxes 60, 62, 64, and so on. A larger box size means a larger price move must occur before another price is plotted on the chart. Price moves that are not large enough to require another X being plotted in the chart are noise and irrelevant to the analyst. Increasing the box size reduces the amount of noise in the chart.

A horizontal move along the point-and-figure chart to a new column represents a reversal in the direction of price movement. Figure 2.1 shows an example of a

one-point three-box *reversal* point-and-figure chart, often referred to as a 1x3 point-and-figure. In this version of point-and-figure charting, a column of Xs represents increasing prices and a column of Os represents falling prices. Because the last column of Xs records increasing price, if price behavior reverses and begins to fall, a new column to the right is used for this price movement.

Analysts can choose various reversal amounts, but a common technique used by many point-and-figure analysts is the three-box reversal method. In this method, a reversal is recorded only when the price has reversed by at least three boxes from the last price marked on the chart. In Figure 2.1, price observations of 62.48, 61.39, and 60.33 would not be recorded; the price would need to drop to or below 60.00 before a new column would be started; the new column would contain Os, as it would be a column representing falling prices.

In Figure 2.1, with the last column showing rising prices and the highest box marked at 63.00, another X will be recorded if price rises to or exceeds 64.00. If price falls to or below 60.00, a new column of Os will be started. Nothing will be recorded on the chart if price fluctuates between 60.00 and 64.00. Trades occurring within that range are considered noise and are not plotted.

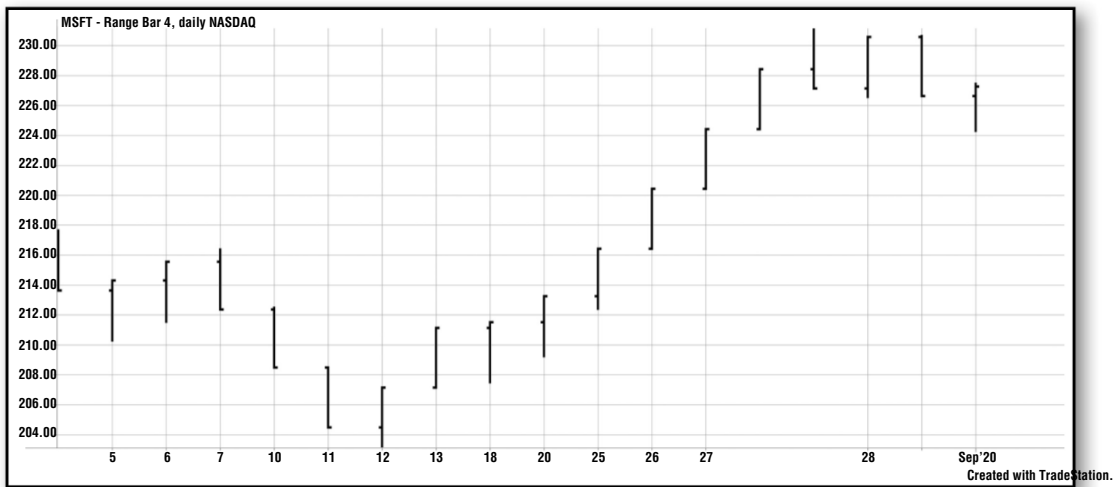
As with most charting methods, users have adapted the point-and-figure charting method to meet specific needs. Analysts interested in longer-term trends use larger box sizes and multibox reversals when plotting point-and-figure charts than those interested in shorter-term movements. With a larger box size and a larger reversal, fewer observations will be plotted. Point-and-figure chart users can reduce the noise that appears in the data.

As with the charts we considered in Chapter 1, price is measured along the y-axis on point-and-figure charts. However, time is not measured on the x-axis. The x-axis is nonfunctional on point-and-figure charts. Point-and-figure charts emphasize the direction and amount of price movement but are not concerned about the time over which that price movement occurs.

## Range Bars

Point-and-figure charts look very different from many of the charts used by modern-day traders. Range bars (and a similar method, momentum bars, developed in the past several decades to capture price movement, have a similar look to time-based bars. The range bar chart uses a standard bar with a high, low, open, and close, but each bar “interval” is a particular price range rather than a specific time period. As with point-and-figure charts, price is plotted on the vertical axis, but time is not on the horizontal axis.

Figure 2.2 is an example of a range bar chart constructed for Microsoft Corp. (MSFT) for August 2020. Notice that the height, or range, of each bar is the same; this chart was constructed with each bar having a range of \$4. A left hash mark denotes the opening price of a new bar. When price has moved so that the bar has a height of 4, the bar is closed, with a right hash mark denoting the price at which



**FIGURE 2.2** Range Bar Chart for MSFT Using Daily Data

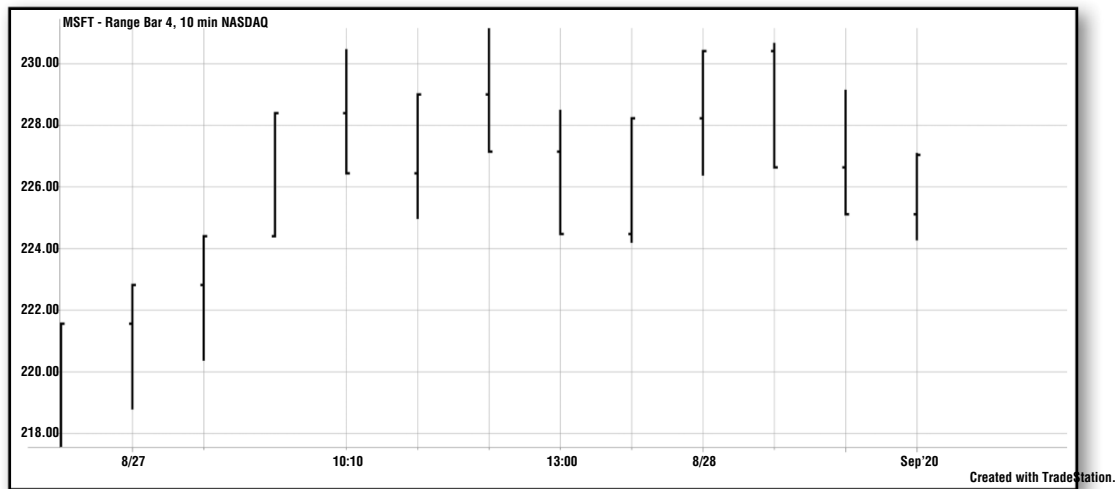
that occurs; notice that this right hash mark always occurs at the top or the bottom of the range bar.

The time it takes for a bar to be completed varies, depending on price volatility. Dates are denoted on the horizontal axis to provide users with information regarding when the bar occurred, but the dates are not evenly spaced on the horizontal axis. From August 10 to August 13, four range bars were drawn. It was not until August 25, 12 days later, that the next three bars were plotted; price volatility was much lower during the August 13–August 25 time period than it had been the previous few days. On August 27 three range bars were drawn, indicating a large single-day price range and high volatility. The greater the volatility, the more quickly range bars are plotted.

The range bars in Figure 2.2 are created using daily price data. We can tell that price varied enough over the entire day that three range bars were drawn. We cannot tell, however, how much intraday volatility occurred. In other words, the three range bars indicate a price range of \$12, but we cannot detect how that price range unfolded. Was it a steady price rise during the day? Or did price rise to near the top of the range, fall back to near the bottom of the range, only to rise again several times during the day?

To learn more about the intraday volatility, we create a range bar chart based on more frequent data observations. Figure 2.3 shows such a chart constructed using data collected at 10-minute intervals for the last two trading days in August. The figure shows the same large price range occurring on August 27, but it also shows a lot of price volatility around the \$228 level during the latter part of the trading day.

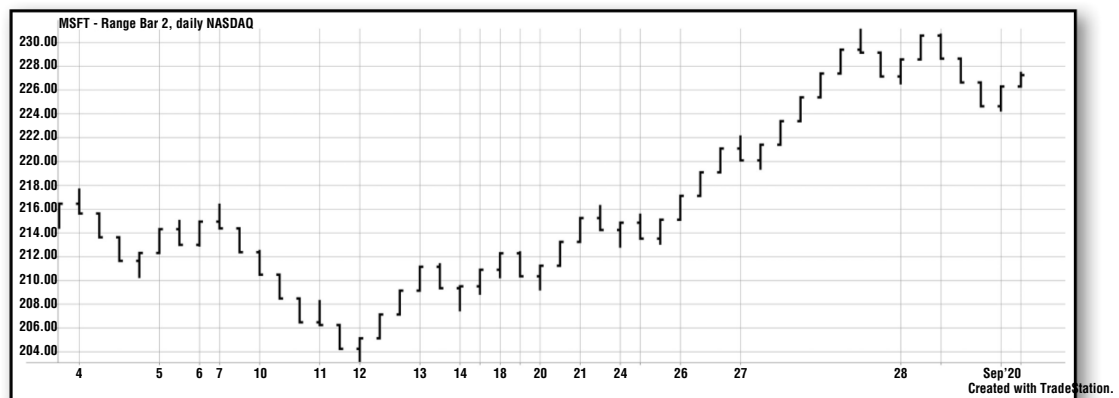
Volatility that is characterized by directional price movement, such as price rising by \$4, then by \$4, and then by another \$4, will result in range bars that form an up-trend. Volatility that is characterized by price rising by \$4.50, then dropping by \$5, then increasing by \$5.10, only to drop by \$5 again, is nondirectional; this volatility



**FIGURE 2.3** Range Bar Chart for MSFT Using 10-Minute Data

shows up on a range bar chart as bars occurring in a trading range. For longer-term traders, the back-and-forth movement around \$228 on August 27 is noise. For shorter-term traders, the range bars that are created using a 10-minute data collection interval can show important support and resistance levels.

In addition to determining the data interval to use for a range bar chart, analysts must choose the price range for bar construction. The smaller the range, the more frequently a bar will plot. Figure 2.4 provides an example of a range bar chart for MSFT for August 2020 in which each bar has a range of \$2, constructed using a daily data interval. This chart provides more detail of price movements than does Figure 2.2. This additional detail can be useful to shorter-term traders but is noise to longer-term traders. When choosing a range for the bars, consider your investment style and the volatility of the underlying security. Higher-priced securities usually have a higher dollar average daily trading range. For example, it might be realistic for a stock trading around \$200 to range in price by \$4, or about 2% on a typical day. A stock trading for \$10 would have a much smaller dollar trading range on a typical day; even a \$1 range would represent a 10% price move for that stock.



**FIGURE 2.4** Range Bar for MSFT with \$2 Range

## ■ Activity-Based Intervals

### Volume-Scaled Charts, or Volume Bars

Figure 2.5 presents an alternative charting technique for incorporating volume into a chart. This method creates one bar or candlestick for a particular number of shares or contracts rather than for a set time frame. That is, the data interval is a unit of volume rather than a unit of time. The chart in this figure uses 1,000,000 shares of volume as the interval for each candlestick. Instead of representing a day or some other fixed period of time, each candlestick shows the range of prices while 1,000,000 shares of Twitter, Inc. (TWTR) traded. If an extremely large number of shares of TWTR are traded in one day, as happened on July 8, then many candlesticks will be constructed that day. On days with lighter trading volume, such as July 9, fewer candlesticks are drawn. Like all the charts we have considered, price is measured on the vertical axis; but now volume, rather than time, determines the horizontal axis. New trading days can be determined only by notations along the bottom of the chart.

Volume-scaled charts or volume bars, the charting method in Figure 2.5, emphasize the progression of price over a unit of volume. A price range of \$1 for 1,000,000 shares is visually the same in this chart whether it took one hour, one day, or several days for those shares to be traded. The volume-scaled chart in the figure shows that a few million shares of TWTR sold around the \$33 price early in the trading day, but price quickly rose to over \$35 per share, and much of the volume that day was at a price above \$35.

### Tick Bars

Charts can also be created using trading activity as the interval for constructing bars or candlesticks. A tick chart uses a specific number of trades to create a new bar. Figure 2.6 is a portion of a tick chart for MSFT on August 27, 2020. Each candle in this chart represents 25 ticks. In other words, a new candlestick is created for every



**FIGURE 2.5** TWTR 1,000,000-Share Volume-Scaled Bars



**FIGURE 2.6** 25-Tick Candlestick Chart of MSFT

25 trades, with the shadows indicating the highest price and the lowest price of those 25 trades. So many trades of MSFT were occurring that this graph shows information from only the last 11 seconds of trading that day.

The chart in Figure 2.7 uses 1,000 ticks to construct each candlestick. Using this data interval allows for approximately the last two hours of trading to be depicted in the chart. During times of the day when more trades are occurring, candles will be plotted more quickly; at other times of the day, it will take longer for 1,000 trades to occur and candles will be constructed more slowly. Remember that each candle represents the range of price over 1,000 ticks, not over any set period of time. Notice that there are six candles constructed in the last second of trading. Earlier in the chart it could take several minutes for 1,000 trades to occur and a candle to be constructed. Thus, time is not measured by equal distances on the horizontal axis for tick-based charts.

Each candle in Figure 2.7 represents prices traded through 1,000 ticks, but each of those ticks can be trades of different sizes. One tick may be 100 shares and the next tick may be 500 shares. As discussed earlier, a volume-based chart uses a standard number of shares or contracts to create each candlestick but ignores how many ticks were required to accumulate that volume.



**FIGURE 2.7** 1,000-Tick Candlestick Chart of MSFT

## ■ Market Profile

Over the years, traders have developed additional charting tools to organize, view, and analyze price data. J. Peter Steidlmayer, a trader at the Chicago Board of Trade (CBOT), developed a charting technique in the mid-1980s called Market Profile.

When buyers and sellers are in balance, or the market is in equilibrium, a fair price is set. Buyers and sellers can trade around this price, redistributing the security. If an imbalance of supply and demand occurs, price will move. If the imbalance is caused by excess supply, price will fall. Price will continue to fall until no sellers are willing to sell at the new current price level. When demand exceeds supply, an imbalance in the opposite direction will occur; price will increase until no more buyers exist at the new price level. Price movement is viewed as the market players negotiating a balance.

When Steidlmayer watched this negotiation unfold, he noticed a tendency for price observations to clump around a price level that he saw as the “fair” price. He divided the trading day into a number of time periods and recorded in how many of the time periods each price level was observed. He saw the price distribution often took on the shape of a bell-shaped curve, with a few observations of prices that were too high or too low to persist across many of the time periods.

Consider a forex trader who is watching the euro/dollar (EUR/USD) trade in a range of 1.1800–1.1900. The trader would plot price on the vertical axis, as in

1.1899	
1.1898	
1.1897	A
1.1896	AB
1.1895	AB
1.1894	AB
1.1893	ABCD
1.1892	ABCDE
1.1891	ABCDEFGH
1.1890	ABCDEFGHIJK
1.1889	ABCDEFGHIJK
1.1888	ABCDEFG
1.1887	ABCDE
1.1886	AB
1.1885	A
1.1884	A
1.1883	A
1.1882	
1.1881	

**FIGURE 2.8** Market Profile

Figure 2.8. The trading day will be divided into time periods with a notation, and often colors, used to represent each time period. For example, suppose A represents 8:00 a.m.–8:30 a.m., B represents 8:30 a.m. –9:00 a.m., C represents the next 30 minutes of trading, and so forth. If trading ranges from 1.1883 to 1.1897 during the 8:00–8:30 time period, an A is placed on the chart next to those prices. A B is placed on the chart for prices observed from 8:30 to 9:00. A C is placed on the chart for prices that occur during the next 30 minutes.

As this process continues throughout the day, price or prices that are touched in many of the time periods become obvious. These prices are observed frequently, represent a balance between supply and demand, and are considered fair prices. A high price, such as 1.1897, occurred but represented an imbalance of supply and demand; the price was higher than was fair, and buyers stopped purchasing. Likewise, lower prices, such as 1.1883, represented a market imbalance; buyers could not continue to find sellers at that price.

In order to account for trading in a 24-hour trading day, the CBOT began using the capital letters A to X to represent the first twenty-four 30-minute periods of the day from midnight through noon and lowercase letters a to x to denote the twenty-four 30-minute periods that occur from noon to midnight. Others have used various colors and symbols to denote shorter time intervals.

## ■ Conclusion

Individual traders and technicians modify and personalize all charting methods to best meet their personal trading styles and to capture the information most appropriate for the security they are trading. Charts are the technician's tool. It is helpful to become familiar with the various charting techniques and the principles behind them. Once you have understood the basics, you will be able to customize charts to best meet your needs.

# Moving Averages

From Charles D. Kirkpatrick II and Julie R. Dahlquist, *Technical Analysis: The Complete Resource for Financial Market Technicians*, 3rd Edition (Old Tappan, New Jersey: Pearson Education, Inc., 2016), Chapter 14.

## Learning Objective Statements

- Contrast various types of moving averages used in trend analysis
- Illustrate four ways moving averages are used by technicians
- Analyze trend movement using Directional Movement Indicators
- Compare common envelope, channel, and band indicators

One of the most successful methods of identifying and profiting from trends is the use of moving averages. A moving average is a constant period average, usually of prices, that is calculated for each successive chart period interval. The result, when plotted on a price chart, shows a smooth line representing the successive, average prices. Moving averages dampen the effects of short-term oscillations. Many of the most successful technical investment managers use moving averages to determine when trends are changing direction. Moving averages are especially useful in markets that have a tendency to trend.

Moving averages have been tested by academics and shown to have statistical significance. Brock, Lakonishok, and LeBaron (1992) were the first to demonstrate, using modern statistical bias-reducing methods, that moving average crossover signals have intrinsic value. As with most academic studies, the results of Brock, Lakonishok, and LeBaron's have been somewhat controversial. Even though some have since criticized their study, other researchers have validated their results. (Incidentally, the Brock, Lakonishok, and LeBaron study provides one of the more useful arguments against the Random Walk and Efficient Markets hypotheses.) Although the Brock, Lakonishok, and LeBaron study focused on the Dow Jones

Industrials, later studies have used moving average crossover systems for market data in other countries with generally the same positive results. Detry and Gregoire (2001) provided a summary of these studies.

There obviously is something to moving averages. Traders and trend investors, of course, have known all this for many years, but technical analysts now feel more comfort in what they have been doing. In this chapter, we discuss some of the moving average methods and strategies that technical analysts use, as well as introduce some variations on moving averages, such as Bollinger Bands, envelopes, and directional movement indicators.

## ■ What Is a Moving Average?

The moving average is one of the oldest tools used by technical analysts. Daily fluctuations in stock prices, commodity prices, and foreign exchange rates can be large. Moving averages tone down these fluctuations—deemphasizing but sometimes distorting fluctuations. Technical analysts use moving averages to smooth erratic data, making it easier to view the true underlying trend.

The principal reason that moving averages are used is to smooth out shorter fluctuations and focus on the trend that fits with the investor's time horizon. A moving average by its nature is just one number that represents a net of certain past numbers. For example, a 20-day moving average is one number that represents all the prices for the past 20 days. As such, it filters out each one of the prices during the past 20 days and tells us how the group of 20 days, rather than its separate parts, is behaving.

## ■ How Is a Simple Moving Average Calculated?

Table 3.1 contains the daily closing prices for WMT (Walmart) from November 18, 2014 through February 26, 2015. Most moving averages of prices are based on closing prices, but they can be calculated on highs, lows, daily means, or any other value as long as the price type is consistent throughout the calculations. We use closing prices.

**TABLE 3.1** Price Data and Moving Average Calculations for WMT Daily Price Close between November 18, 2014 and February 26, 2015

Date	Open	High	Low	Close	10-Day SMA	26-Day SMA	10-Day EMA	10-Day LWMA
11/18/2014	83.50	83.92	83.34	83.79				
11/19/2014	83.96	85.64	83.92	84.99				
11/20/2014	84.80	85.29	84.04	84.58				
11/21/2014	85.34	85.44	84.58	84.65				
11/24/2014	84.85	85.61	84.77	85.40				
11/25/2014	85.42	85.51	84.39	84.95				

**TABLE 3.1** (Continued)

Date	Open	High	Low	Close	10-Day SMA	26-Day SMA	10-Day EMA	10-Day LWMA
11/26/2014	84.90	85.11	84.48	84.98				
11/28/2014	86.18	88.09	85.90	87.54				
12/1/2014	86.72	87.07	85.75	86.22				
12/2/2014	86.27	86.70	85.93	86.40	85.35		85.08	85.78
12/3/2014	85.96	86.00	84.68	84.94	85.47		85.05	85.71
12/4/2014	84.13	84.82	83.65	84.76	85.44		85.00	85.58
12/5/2014	84.90	84.90	83.51	84.12	85.40		84.84	85.34
12/8/2014	84.15	84.67	83.85	84.23	85.35		84.73	85.13
12/9/2014	83.65	84.21	82.65	83.56	85.17		84.52	84.80
12/10/2014	83.93	84.31	82.90	82.98	84.97		84.24	84.40
12/11/2014	83.18	84.50	83.16	83.83	84.86		84.16	84.19
12/12/2014	83.52	85.00	83.52	83.81	84.49		84.10	84.00
12/15/2014	84.26	84.70	83.05	83.94	84.26		84.07	83.90
12/16/2014	83.62	84.76	82.94	82.96	83.91		83.87	83.67
12/17/2014	83.28	84.26	82.95	84.23	83.84		83.93	83.73
12/18/2014	84.80	85.95	84.28	85.94	83.96		84.30	84.11
12/19/2014	86.26	86.34	85.16	85.16	84.06		84.46	84.33
12/22/2014	85.32	86.40	85.29	86.38	84.28		84.81	84.75
12/23/2014	86.69	87.08	86.36	86.66	84.59		85.14	85.18
12/24/2014	86.97	87.07	86.39	86.43	84.93	84.90	85.38	85.51
12/26/2014	86.18	87.14	86.01	86.91	85.24	85.02	85.66	85.87
12/29/2014	86.46	87.07	86.40	86.64	85.53	85.08	85.83	86.13
12/30/2014	86.52	87.13	86.48	86.79	85.81	85.17	86.01	86.36
12/31/2014	87.04	87.44	85.86	85.88	86.10	85.22	85.98	86.37
1/2/2015	86.27	86.72	85.55	85.90	86.27	85.24	85.97	86.33
1/5/2015	85.72	86.32	85.51	85.65	86.24	85.26	85.91	86.22
1/6/2015	85.98	86.75	85.79	86.31	86.36	85.31	85.98	86.23
1/7/2015	86.78	88.68	86.67	88.60	86.58	85.36	86.46	86.64
1/8/2015	89.21	90.67	89.07	90.47	86.96	85.52	87.19	87.35
1/9/2015	90.21	90.39	89.25	89.35	87.25	85.63	87.58	87.79
1/12/2015	89.36	90.31	89.22	90.02	87.56	85.83	88.02	88.29
1/13/2015	90.80	90.97	88.93	89.31	87.83	86.00	88.26	88.61
1/14/2015	87.65	88.52	86.50	86.61	87.81	86.10	87.96	88.39
1/15/2015	87.00	87.78	86.70	87.38	87.96	86.22	87.85	88.31
1/16/2015	87.20	87.46	86.23	86.77	88.05	86.34	87.66	88.09
1/20/2015	86.82	87.70	85.55	86.69	88.15	86.49	87.48	87.84
1/21/2015	86.10	86.91	85.71	86.64	88.18	86.59	87.33	87.57
1/22/2015	87.23	88.40	86.86	88.30	88.15	86.77	87.50	87.59
1/23/2015	88.42	89.26	87.89	88.51	87.96	86.94	87.69	87.66
1/26/2015	88.31	89.16	88.12	88.63	87.89	87.16	87.86	87.78

(continued)