# CONTENTS

*Preface*  ix  
*The Pioneers and Their Connections*  xiv  

1. A Brief History of Investments  1  
2. Harry Markowitz and Portfolio Selection  18  
3. William Sharpe and the Capital Asset Pricing Model  51  
4. Eugene Fama and Efficient Markets  81  
5. John Bogle and the Vanguard Portfolio  113  
6. Myron Scholes and the Black-Scholes / Merton Option Pricing Model  140  
7. Robert Merton, from Derivatives to Retirement  173  
8. Martin Leibowitz, from Bond Guru to Investment Strategist  199  
10. Charles Ellis and Winning at the Loser’s Game  255
CONTENTS

11 Jeremy Siegel, the Wizard of Wharton 281

12 So, What Is the Perfect Portfolio? 308

Notes 335
References 367
Index 385
1

A Brief History of Investments

Mesopotamia and the Dawn of Investing

The art of investing has been practiced since the dawn of *Homo economicus*. Investing in its earliest form can be linked to the risk/reward decisions of long-distance trading. During the late Pre-Pottery Neolithic period in the prehistoric Middle East, between 9500 and 8500 BCE, settled village life emerged. Settlers from the Jordan Valley engaged in the long-distance trade of obsidian, domesticated wheat, and sheep with the people of the Central Anatolian Plateau and the Zagros-Taurus arc in what is now modern-day Turkey.¹ The enterprising traders of this period faced significant dangers in these commercial treks, making risk/reward decisions every day they continued in their quest for economic profit. Thanks to some very savvy investment decisions on the part of these merchants, long-distance trade flourished like never before, spanning a distance of fifteen hundred miles and involving a striking variety of raw materials.

If we think of a portfolio in a broad sense, as capital that’s saved or invested for a future purpose, then recent evidence suggests that these Pre-Pottery Neolithic settlers treated grain the way we would treat a portfolio today. Food storage is a vital component of economic development. Twenty-first-century excavations near the Dead Sea in Jordan uncovered strong evidence of sophisticated granaries even before the

¹
domestication of plants. This evidence suggests that the settlers were able to reduce seasonal food risks and settle in a particular area for more than one season a year. These storage facilities, a break from earlier periods, represented a critical form of risk management, allowing the settlers to smooth their consumption, ensure against droughts, and plan for the next sowing season.

Investing is also directly linked to the time value of money, the notion that a dollar today is worth more than a dollar tomorrow. Investing is really about moving economic value across time—for instance, providing an entrepreneur with a needed source of cash today in return for a promise to share in future profits. Even before writing was invented, accounting still played an important role, since it was critical to have a record of transactions and contracts between two parties. Evidence for accounting in the form of commodity record keeping may extend back to 7000 BCE, based on the interpretation of the use of tokens—about the size of board game pieces—in the early urban settlements of Mesopotamia. What these tokens were used for wasn’t initially clear to archaeologists, but one archaeologist eventually recognized that old Uruk tablets dating back to 3100 BCE, complete with cuneiform writing, also contained pictographs of these very tokens. For example, the symbol for food evolved from a token shaped like a dish. Most pictographs represented everyday commodities such as sheep and loaves of bread. Virtually all of these old tablets were accounting records or contracts presumably used by some kind of central authority, such as a temple, to account for what goods were coming in and going out of the temple.

These tablets also provide us with records of ancient loans. For example, a Sumerian record from around 2400 BCE may be the oldest known personal loan: Ur-garima lent Puzur-Eshrat forty grams of silver and nine hundred liters of barley. Around that time the first known surety bond was issued, with a second party guaranteeing repayment if the first party failed to reimburse the lender. A stone tablet written in cuneiform characters indicates that such a bond, guaranteeing the payment of grain, was issued in Nippur in Mesopotamia. The bond was drawn up by a scribe, included the names of four witnesses, and, typically for its time, was executed in triplicate.
Other ancient records indicate more complex business arrangements, including forerunners to what we think of as modern financial instruments. For example, a type of derivative contract actually dates back to 1900 BCE. Derivatives are named because their prices are derived from some underlying security, such as the price of a commodity. The first known derivatives contracts—what today would be called futures contracts—were written in Mesopotamia in cuneiform script on clay tablets and involved the future delivery of goods, often combined with loans. One such contract was between a merchant, Magrat-tum Akshak-shemi, and his client, Damqanum, agreeing to the future exchange of thirty planks of wood of specified lengths.6

When famed archaeologist Sir Leonard Woolley excavated the Mesopotamian city of Ur, one of his startling discoveries was of the earliest known financial district, along with the possible birth of the bond trading market. Woolley discovered that in 1796 BCE an educated businessman named Dumuzi-gamil along with his partner, Shumi-abiya, borrowed five hundred grams of silver from another businessman, Shumi-abum. Dumuzi-gamil agreed to return his share of the silver in five years—a relatively long-term loan—at an annual rate of interest of 3.8 percent.7 But rather than simply hold on to the loan, Shumi-abum turned around and sold it to some well-known merchants, who successfully collected it when the loan was due, thus indicating a market for bond trading. The Ur documents suggest that there was a liquid market for such personal promissory notes. Reflecting the principles of time value of money, Dumuzi-gamil likely used the loan as a productive source of immediate cash to finance his entrepreneurial venture as a bread distributor. He also used some of the funds to act as a banker, lending at a monthly interest rate of 20 percent—which works out to an annual compound rate of almost 800 percent!

Not all investments and trades panned out for everyone. Even centuries before social media, reputation mattered, and around 1750 BCE a copper trader in Dilmun named Ea-Nasir certainly didn’t have a good one. In fact, what are arguably the world’s oldest complaint letters (albeit ones written on tablets) cast him in an unflattering light. His career seemed to have started well, and he was considered a good credit risk
while buying and selling for the palace at Ur. However, many traders’ complaints about the quality of his copper were uncovered, etched in stone for all eternity. One man named Nanni was so upset that he covered both sides of an entire tablet with his complaints: “You have offered bad ingots to my messenger. . . . Who am I that you are treating me in this manner—treating me with such contempt? . . . You will learn that here in Ur I will not accept from you copper that is not good.” Archaeological evidence suggests that Ea-Nasir’s wealth eventually declined, and he was forced to branch out from copper trading into less lucrative markets such as real estate and secondhand clothes trading.8

From BCE to CE: Coins, Bonds, Stocks, and More

The lifeblood of any financial system is money. Money acts as a medium of exchange, allowing for a more efficient system than a world of barter. Money also acts as both a unit of account that indicates our wealth level and a store of value that can be saved and used later. To perform these functions, money needs to be durable, interchangeable, portable, and reliable. While barter is thought to have been around for at least one hundred thousand years, the earliest known coins were found by archaeologists in the Temple of Artemis at Ephesus, in present-day Turkey, and thought to be minted in 600 BCE.9 Made of gold and silver alloy, the coins featured the head of a roaring lion. Comparing value across historical eras is difficult, but it’s thought that each coin could buy about ten goats.

Subsequent to the early derivatives in Mesopotamia, another type of derivatives contract, the call option, was used around 600 BCE in ancient Greece. Call options allow the buyer the option to buy a particular asset at an agreed-upon price at a future date. One of the first recorded accounts of such a transaction is related to the underlying price of olive oil presses. At the time, olive oil was used for making soap and for cooking and was also used as fuel for lamps and as a skin softener.10 After several years of poor harvests, the Greek philosopher and mathematician Thales of Miletus (known as one of the Seven Sages of Greece) used astronomy to predict an upcoming bumper olive crop. During the
winter, he negotiated call options to buy the presses in the spring at their depressed current prices. He bought all the olive presses he could find from discouraged growers and made a fortune when the predicted bumper crop arrived. As recounted later by Aristotle in his famous *Politics*, Thales “succeeded in proving it is easy for philosophers to become rich if they so desire, though it is not the business in which they are really about.”¹¹

In the fourth century BCE, the well-known Greek orator Demosthenes was grappling with an investment issue. His father, with the same name, had died owning a furniture factory, a weapons factory, several loan investments, and other assets—early evidence of an investment portfolio, believed to be valued at over $11 million today. The estate, however, was mismanaged by his guardians, so when Demosthenes turned twenty-one, he took them to court. In his argument, he sought to establish both the original value of the estate and what it should have been valued at had it been managed properly, performing what today would be called a net present value calculation.¹² He was successful before the court but ultimately only received a fraction of the estate’s value.

Since the third century BCE and perhaps earlier, endowment funds had been established in Greece¹³ and later in the Roman Empire. The purpose of an endowment is to collect charitable donations and distribute funds generated from the endowment’s investments while preserving the capital. Some of the earliest endowments were used to distribute cash awards to various tribes at annual celebrations, to pay teachers’ salaries to educate youths, or to fund oxen sacrifices in religious rites. In some cases the principal was lent at a rate of 12 percent, although a rate of 10 percent was common later. As is the case today, there was even a tax angle to donations.¹⁴ Many of the best-known endowments from this period were structured in such a way that elite and wealthy donors could limit their tax liabilities by sheltering real estate from possible tax assessment and perhaps even enhance their private wealth.

Around 221 BCE the standardized bronze coin was introduced to China by its first emperor, Qin Shi Huangdi, as the first currency of the now-unified empire and as its only acceptable currency, although
archaeological records show that similar coins may have been produced hundreds of years earlier. These coins had a standardized weight of half a liang, or about eight grams. The coins were ring-shaped with a square hole in the middle, allowing them to be strung together, and continued to be minted until the end of the empire under Emperor Puyi in 1912. These coins (historically called “cash” in English) are important, because as with present-day money they were fiat currency, not backed by any precious metals such as gold but only having value because of decree and convention.

Once coins became accepted as fiat currency and the weight and type of metal of the coin were no longer important, it was only a matter of time until paper currency became accepted. Banknotes, the most common form of currency today, originated in China during the Tang dynasty (618–907 CE). A banknote or bill is a guaranteed promise to pay the bearer or owner of the note on demand. Chinese merchants invented the first bill around 800 CE. The idea was that a certain amount of currency would be deposited in a local merchant’s guild, and the merchant would receive a written receipt. That receipt could then be brought to another town and exchanged for currency through that guild. The different guilds would periodically settle the amounts owed, thus avoiding the danger of transporting a lot of cash. By 841 CE, the government prohibited this custom so as to monopolize the issue of paper money.

During the Song dynasty (960–1279 CE), under Emperor Zhenzong (r. 997–1022), the world’s first official paper money was designed. Notes were printed that were worth 1 to 10 guan (or strings) that equaled 1,000 to 10,000 cash equivalents, respectively. Upon redemption, however, only a portion was actually paid in cash. For example, 1 guan could be redeemed for 770 cash. Centuries later European explorers such as Marco Polo introduced the concept of paper money to the Western world. Today, paper money is ubiquitous. On the front of U.S. paper money is the promise “this note is legal tender for all debts, public and private,” and on the back is the statement “in God we trust.” In fact, you are really trusting the U.S. Treasury and the Federal Reserve to make good on this promise.
The precursor to government bonds—and the first form of public finance—occurred in Venice in 1172. What we think of as bonds today were actually born by accident. The republic of Venice was in a struggle with Byzantium, the eastern successor to the Roman Empire, over control of the Adriatic Sea. On fabricated charges that the Venetians had set fire to a neighborhood in Constantinople, the emperor of Byzantium, Manuel I Komnenos, created a hostage crisis by seizing Venetian merchants, locking them in prison, and taking their goods. The doge of Venice, Vitale II Michiel, needed to quickly build a fleet of ships to wage a war in order to free the hostages and recover the Venetian property. Due to religious usury laws, however, loans were illegal.

To fund the fleet, the doge devised a borrowing scheme (technically not a loan) known as a prestito, like a mandatory tax but with a promise to pay 5 percent interest until the debt was retired. The scheme created a lender-borrower relationship between the city and its citizens rather than putting creditor control in the hands of a few investors. The prestiti became quite popular and were eventually traded frequently in the Rialto Market. Unfortunately, things failed to go well for the doge. While his fleet of 126 ships was anchored off the coast of Asia Minor, Manuel I Komnenos stalled for time by promising a negotiated resolution. However, the Venetian fleet was suddenly ravaged by plague. Thousands died, with only about a quarter surviving. The mission was cut short, and the survivors returned home in defeat. When the Venetians saw that the doge had survived but so many others had perished, a mob chased him down and executed him. Furthermore, the weakened republic, while continuing to make interest payments, was never able to retire the principal of the loan.

Public finance became very useful to the expanding European powers. The first government bonds were issued in Amsterdam in 1517, long before the Netherlands existed as a country, and the first bonds were issued by a national government in 1694, through the Bank of England, to fund England’s war against France. One of the oldest known perpetual bonds, paying a set interest rate in perpetuity to whoever holds the bond, was issued by the Dutch water board of Lekdijk Bovendams in 1648 and written on goatskin; the money raised was used to pay
workers who constructed a series of piers near a bend in the river to prevent erosion. What’s unique about the bond is that it still pays interest today. One of five known bondholders is Yale University, where the bond is displayed in the Beinecke Library. In 2015, Timothy Young, the library’s curator of modern books and manuscripts, traveled to Amsterdam to collect twelve years of interest, worth €136.20, or $153, while in 2003 the university collected twenty-six years of back interest.

The world’s oldest shareholding company dates back to 1369, when a group of French millers formed Société des Moulins de Bazacle. The mill owners who shared a perpetual lease on the river arranged a profit-sharing plan. A few years later, one of the millers was a decade late in a debt repayment to a merchant, and the resolution to the subsequent lawsuit resulted in a new corporate structure that included the now common innovation of an elected board of directors to protect shareholders. The company was considered a distinct legal entity apart from the shareholders. The Société des Moulins de Bazacle survived floods that destroyed the dam, ice floes, famine, plagues, and a revolution while still paying out 100 percent of its profits in dividends. Shares were transferable, and in some years there was turnover of about 20 percent of the shares. There was one noteworthy constraint on share turnover: in addition to paying a large notary fee, new shareholders had to host a dinner for the entire board of directors.

The first “modern” joint-stock companies were the British East India Company (EIC), founded in 1600, and the Dutch East India Company, also known as the Vereenigde Ost-Indische Compagnie (VOC), founded in 1602. The EIC was formed as a monopoly to trade in India and later China, while the VOC was a government-directed amalgamation of several Dutch companies that were granted a monopoly on trade in India. In 1609, the VOC was the first modern joint-stock company to raise a large amount of capital by issuing dividend-paying shares. For over a century, the shares paid dividends of an incredible 22 percent. Of course, these rewards were associated with tremendous risks: the dangers associated with long-distance trading and the uncertainty surrounding the new corporate form itself. Initially, the shareholders could either reinvest in future voyages or receive the...
distributed dividends. If shareholders were disappointed, they could demand their share capital back and withdraw. By 1609, however, VOC directors deemed the shares to be nonrefundable. An active secondary market developed for the shares, as there were over one thousand share subscribers in Amsterdam alone. By 1607, one-third of the original shares had changed hands. While the original plan called for the liquidation of its shares in ten years, the company wasn’t formally dissolved until 1796.

**Early Purported Bubbles**

A bubble, in the financial sense, is a sometimes fuzzy word referring to the rapid increase of the price of an asset not explained by fundamental factors. (There will be more on bubbles later in this book.) One of the earliest purported bubbles was alleged to have occurred in the Netherlands in the seventeenth century, was popularized in a nineteenth-century book, and was called into question in the late twentieth century: the infamous tulip bubble. The tulip was originally a Middle Eastern flower that became immensely popular in Dutch gardens. Prior to the 1630s, tulip bulbs were physically traded between growers in the summer, when the bulbs could be pulled from the ground.\(^{23}\) Subsequently, florists started buying and selling bulbs still in the ground, using promissory notes. Given the lag between the buying and selling of the notes and the actual delivery months later, speculators emerged who were often highly leveraged.

According to Charles Mackay in his 1841 classic *Extraordinary Popular Delusions and the Madness of Crowds*,\(^ {24}\) in 1637 when the mania was at its peak, twelve acres of land were offered for one rare bulb, Semper Augustus. Mackay recounts the anecdote of a sailor who mistakenly ate a rare bulb, at the time worth the cost of feeding an entire ship’s crew for a year, that he thought was an onion. However, according to Mackay, in February 1637 the market dried up because traders could no longer find buyers, and prices plummeted. Robert Shiller, recounting the mania in our time, said that “the Dutch referred to it as a ‘windhandel,’ which, when translated directly, means ‘wind trade.’ What they meant was that
the prices of those tulips were like the wind; there was nothing to them. So, it’s just air.”

However, more recent research by Peter Garber has debunked many of the tulipmania myths. Many of the cited prices were based on futures contracts, which were illegal at the time and thus unenforceable. Buyers paid only a fraction of the contract price up front. Many of the purported offers for rare bulbs can be traced to moralistic pamphlets distributed at the time, basing their examples on what it might cost to enter into a futures contract at the peak of speculation rather than actual offers. There were also fundamental reasons for the initial price increases, as it became fashionable in France for women to display fresh tulips at the top of their gowns. There is no evidence of a large inflow of foreign money or lending for speculation. Similarly, there are no reliable price data for just after the purported crash in the price of rare bulbs. Subsequent history suggests that it’s natural for the price of rare tulip bulbs to decline dramatically over time. Garber’s observation regarding “the implausibility of a Dutch businessman leaving a highly valuable bulb lying about for a loutish sailor to eat for lunch” seems to have escaped Mackay’s retelling of the story. Interestingly, Garber does note a quick rise and sudden crash of common, generic tulip bulbs—not part of the tulip lore—that he can’t explain.

Another early stock bubble is forever associated with one of the most colorful, innovative, and controversial figures in investment history, the Scotsman John Law, born in 1671. John’s father, William, was a goldsmith but successfully moved into the moneylending business. In 1683, shortly before his death, he bought an estate north of Edinburgh, which was to go to his eldest son, John. William’s second wife, Jean Campbell, was assigned as John’s principal guardian. Mother and son quarreled, and at age sixteen John left home (or perhaps was tossed out). He sued his mother in court for lack of support. In her court testimony, Jean complained of John going out late at night and gambling. The case was eventually settled out of court, and John Law apparently used some of the money to settle his gambling debts.

At age twenty-three, Law killed a man in a duel in Bloomsbury Square and was sentenced to death, but English authorities arranged for his
escape from prison. He traveled to the continent and used his mathematical skills to become a bookmaker. At the same time, he wrote essays on monetary innovation. He submitted many proposals to French authorities for the establishment of a bank in France. After King Louis XIV died in 1715 and France was in a state of bankruptcy, Law was appointed controller general of finances by young King Louis XV’s regent, the Duke d’Orleans.

Law, as a friend of the French regent, was able to establish a bank authorized to issue fiat money, or paper notes, as legal tender, the first such full-scale use of fiat currency in Europe. Law also established the Mississippi Company to develop French territory along the Mississippi River in North America. Later he was granted a twenty-five-year monopoly on colonial trade as well as on the beaver fur trade in Canada and the ability to collect French taxes in return for taking over France’s public debt, as part of a system or, as some later argued, a scheme. This system had several moving parts but essentially involved converting government debt into a sort of government equity. Law allowed the public to invest in the company, but he also had an incentive to maximize the price in order to entice debtors to convert to equity, thus helping to create hype around the worth of the stock. The Mississippi Company also grew through mergers and acquisitions.

In 1719, a speculative frenzy in Mississippi Company shares occurred in France. In current terminology, the target price-to-earnings (P/E) multiple was around 45, almost three times higher than what would be considered a typical P/E multiple today. In 1720, however, when expected profits were slow to materialize, the stock price plummeted. Law was forced to flee the country and went to live in Venice, where he continued to gamble and traded in paintings.

A parallel bubble was playing out in England around the same time. The South Sea Company was a joint-stock company, founded in England in 1711. The company had monopoly trading rights to much of South America, even though Spain and Portugal had well-established empires there. This trade, however, was of minor importance, since it was established to help the government organize the national debt (much like the Mississippi Company), which was incurring high
borrowing rates after nearly twenty years of expensive warfare. In 1719, the South Sea Company submitted a comprehensive scheme to Parliament to offer its own equity to public creditors in return for their assets (akin to the government bonds they owned). The proposal to Parliament, accompanied by considerable bribery, succeeded. The company was able to lure public creditors with a rising stock price and extended purchase terms. At the beginning of 1720 the share price was at £130, but by June it had risen to almost £1,000. However, confidence in the stock waned as the South Sea Company’s future prospects were questioned, and by October the share price had fallen to around £200.

Rising prices by themselves don’t imply a bubble. They may reflect increasingly profitable opportunities. Were the rapid stock price increase and subsequent collapse of the Mississippi Company and the South Sea Company true bubbles? Again, Garber disputes this characterization, as does the historian Francois Velde. According to Garber, Law had a plan to revitalize the French economy through financial innovation and reform. As Law gained more power, his chances of economic success grew. The decline in the Mississippi Company share price coincided with the ascension of his enemies, who were bent on dismantling the company. Velde contrasts the common English name of the episode, the Mississippi Bubble, with the original French name, *le système de Law*. Velde notes that the purported bubble didn’t arise spontaneously but rather was part of Law’s system; according to historian Antoin Murphy, “a grand design.” Unlike other purported bubbles, it included only one stock. Velde emphasizes that the stock prices weren’t market prices as we think of them today; the values of the prices were influenced (or manipulated) by Law. The real question is whether the price collapse revealed true value. Velde concludes that at the highest point, the price pegged by Law was probably two to three times too high, implying overvaluation not by a “frenzied and irrational market, but by Law himself.”

In Britain, the South Sea Company stock declined at the same time as many other stocks, including the so-called bubble companies, perhaps as many as 190 that formed between 1719 and 1720. This decline also occurred when the Bubble Act, passed by Parliament that June to
ban the formation of unauthorized companies, began to be enforced on August 18, 1720. Since many stocks were bought on margin, with only a small down payment, the price declines forced liquidation by many sellers who were required to put up additional margins, thus exacerbating the downward pressure on stocks.

According to Garber, a common thread between all three of these purported early bubbles was the existence of fundamental reasons why prices should have risen in the first place. Even today, many companies have promising business models that don’t pan out, but this doesn’t imply that investors in these companies were necessarily acting irrationally. The bubble debate continues, as we’ll see later in this book.\(^{34}\)

**Early Diversification**

While modern portfolio theory didn’t emerge until the middle of the twentieth century, the benefits to diversification appear to have been grasped by the late eighteenth century. It began in France with the finance minister to Louis XVI, who wanted to permit the French to take part in the American War of Independence without burdening French taxpayers. Therefore, the finance minister organized a large number of loans from private investors. Repayment of these loans was in the form of life annuities, with a twist: the lender could determine the person on whose life the annuity was issued. As long as that person remained alive, the creditor received an annual payment. There was a stipulation that the creditor needed to present the person before the French authorities, twice a year, to certify that the person was still living. While it seems obvious today that an annuity based on a younger person would be more valuable and hence more expensive, around 1757 the French government abandoned age grading and returned to flat pricing for all annuities. Initially this had little impact, because most life annuity purchasers were adults who bought annuities on their own lives or on the lives of their spouses or servants. However, it didn’t take long for clever Swiss bankers to figure out how to game the system.

Thus, in 1771 an investment scheme, referred to as “Trente demoiselles de Geneve,” was born. This involved a number of Genevan banks
developing investment trusts that represented pools of life annuities issued by the French government. The banks created a list of young Genevan girls, typically aged five to ten, who were carefully selected and, after surviving smallpox, were named as the contingent lives. Most of the annuity pools involved thirty young girls, hence the name “Trente demoiselles.” The girls, also known as “the immortals,” became like rock stars in their communities because so much wealth was riding on their lives. Genevans from all walks of life invested in the scheme, and an estimated 90 percent of Geneva’s wealth was invested in these annuities, as was money from abroad. Banks resold fractions of these pools to individual investors, just like the modern securitization of mortgages, a major cause of the 2007–2009 financial crisis. Everything was going well until the unexpected bankruptcy of the French treasury, when annuity payments slowed and thousands of investors lost money.

When we think of a diversified security today, we often think of a mutual fund. The first mutual fund, Eendragt Maakt Magt, was actually created centuries ago, in 1774, by an Amsterdam broker named Abraham van Ketwich. Funds were invested in foreign government bonds, bank bonds, and loans to plantations in the West Indies. The fund promised a dividend of 4 percent, with a planned liquidation and return of proceeds after twenty-five years. The offering of two thousand subscriptions sold out, and a secondary market developed for those wishing to sell their subscription. This investment vehicle was similar to today’s closed-end mutual funds. Like a modern mutual fund, one of the articles in the prospectus listed the categories of potential investments. The articles also specified that the fund needed to be diversified at all times with twenty classes of investments, each of which consisted of at least twenty to twenty-five securities.

After its initial success, in 1779 van Ketwich introduced a second mutual fund, named Concordia Res Parvae Crescent. While similar to the first fund, a major difference in this fund was that its investment policy was more liberal, only specifying that the fund invest in “solid securities and those based on decline in their prices would merit speculation and could be purchased below their intrinsic value . . . of which
one has every reason to expect an important benefit.” This strategy sounds much like today’s value investing, pioneered by Ben Graham and his most famous disciple, Warren Buffett.

While these types of investment trusts or closed-end mutual funds eventually spread outside of the Netherlands, first to London in 1868 and then to the United States in the 1890s, a new investment concept eventually developed. In 1924, Massachusetts Investors Trust became the first U.S. open-end mutual fund. Such open-end funds allowed for the continuous issuance or redemption of shares at a fair price to the underlying securities. Coincidentally, it was a Fortune magazine article a quarter century later featuring the Massachusetts Investors Trust that caught the eye of a young Princeton undergrad, Jack Bogle, who was to revolutionize the mutual fund industry—but there will be more about Bogle later in this book.

The Science of Investing in the Twentieth Century

While the art of investing has been practiced for centuries, the science of investing is a thoroughly modern invention, the brainchild of money and mathematics. Although mathematical models of gambling emerged in the 1500s thanks to Girolamo Cardano’s famous 1565 tract Liber de Ludo Aleae (The Book on Games of Chance), it wasn’t until the 1900s that serious investment theories were formulated.

Following the stock market crash of 1929, the Great Depression created the ideal, if unfortunate, circumstances for four major academic treatises on investing. Between 1930 and 1939, Irving Fisher’s The Theory of Interest, as Determined by Impatience to Spend Income and Opportunity to Invest It (1930), John Maynard Keynes’s The General Theory of Employment, Interest, and Money (1936), John Burr Williams’s The Theory of Investment Value (1938), and John Hicks’s Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory (1939) were published. Meant primarily for economists, these tomes had little impact on the investment industry and even less impact among individual investors. In fact, Fisher’s now infamous proclamation that the stock market had reached a “permanently high plateau,” made just three days
before the stock market crashed in October 1929, did little to enhance the reputation of financial economists among practitioners.

However, the investment theories of the 1930s were surprisingly sophisticated, even from a contemporary perspective, and included such ideas as net present value, the dividend discount model, arbitrage pricing, and a precursor to the famous Modigliani-Miller theorems on the irrelevance of capital structure. None was more sophisticated or ambitious than Keynes’s The General Theory of Employment, Interest, and Money, which attempted to integrate investment theory with macroeconomic policy and subsequently served as the user manual for most central banks until the late twentieth century. However, even Keynes had to punt when it came to describing the behavior of financial markets: he likened the stock market to beauty contests and attributed price fluctuations to “animal spirits.”

Nevertheless, as an investor, Keynes performed spectacularly. He managed the endowment of his alma mater, Cambridge University, from 1921 until his death in 1946, and a recent study by David Chambers, Elroy Dimson, and Justin Foo has painstakingly reconstructed the investment returns of Keynes’s portfolio. From the end of August 1921 to the end of August 1946, the annual compound return on his discretionary portfolio was 14.41 percent, versus 8.96 percent for the equally weighted UK equity market index during the same period. But Chambers and Dimson discovered a fact far more remarkable than Keynes’s overall performance: Keynes made a sharp improvement in his investment approach in 1932. From 1921 to 1931 he generated a compound rate of return of only 8.06 percent, only marginally better than the equally weighted UK equity market index return of 6.67 percent. But from 1931 to 1946 Keynes produced a compound return of 18.84 percent, far outstripping the equally weighted UK index return of 10.52 percent during this fifteen-year interval. What did he change?

According to Chambers and Dimson, Keynes discovered the benefits of long-term investing, switching his investment philosophy from a top-down macro-driven trading style to a bottom-up fundamental stock-picking value investor style. This striking shift in portfolio strategy was no doubt precipitated by the disappointing returns Keynes experienced...
during the first half of his tenure as bursar of the Cambridge endowment. When he was criticized for flip-flopping on his position with respect to the gold standard, he purportedly replied, “When the facts change, sir, I change my mind. What do you do?”38 The same could be said for his investment theories.

Unfortunately, none of this learning made its way into Keynes’s The General Theory of Employment, Interest, and Money or any of his subsequent writings. Therefore, apart from Cambridge University and its happy alumni, few others have benefited from the insight Keynes developed during his career as an investor. Despite his enormous impact on macroeconomics and government policy, he had surprisingly limited impact on investing, even as he succeeded beyond all expectations as an investor. Give people a fish, and you feed them for a day; teach people to fish, and you feed them for a lifetime. Keynes provided Cambridge with many fish, but when he died in 1946, he took his rod and reel with him.

This state of affairs changed permanently in 1952.
INDEX

Acorns Advisors LLC, 50
baseball, Merton's interest in, 175–76
basketball, market efficiency and, 98–99
Basu, Sanjoy, 100
Batterymarch, 348n46
Bauer, Phil, 258–59
Bayes, Thomas, 48
behavioral finance, 83–84; adaptive markets hypothesis and, 320; bubbles and, 243, 344–45; Markowitz as grandparent of, 42–43
“The Behavior of Stock-Market Prices” (Fama), 88
Berkshire Hathaway, General Reinsurance Corporation acquired by, 163–64
Bernstein, Peter, 23–24, 44
Bernstein Fabozzi/Jacobs Levy Award, Siegel as winner of, 291
beta: asset allocation and, 216–18; Black, Scholes, and Jensen's research on, 148; capital asset pricing model and, 66, 99–100; Fama-French results and, 101–3; Merton on, 182–83; security market line and, 65. See also risk
"Big-Cap Tech Stocks Are a Sucker Bet” (Siegel), 297
Biggs, John, 215
Black, Fischer, 347n46; Associates in Finance established by, 147; background research in option pricing, 149–50; collaboration with Scholes, 146, 147–48 (see also Black-Scholes/Merton option-pricing formula); Fama's ongoing argument with, 108; first meeting of Scholes, 146; Jensen's collaboration with, 146, 148; option pricing model and (see Black-Scholes/Merton option-pricing formula); publications of, 148, 156–57; on Siegel's Paradox, 284; warrant valuation and, 150–51
Black Monday, 236
Black-Scholes/Merton option-pricing formula, 141, 148–57; corporate application of, 155–56; derivatives and, 159–63; development of, 150–53; enhancements to, 189–90; impact of, 148; Merton's role in, 183–86; operation of, 153–54; publication of, 156–57; Sharpe's simplification of, 73
black swan events, 89–90
Blair Academy scholarship fund, Bogle's management of, 137
Bliss, Robert, 106–7
Blume, Marshall, 109, 143, 292
Bodie, Zvi, 193
Bogle, David, 114
Bogle, John C. (Jack), 15, 113–39, 305; on asset allocation, 134–36, 137, 313; connections to other pioneers, xiv; cost matters hypothesis of, 130–32; dissertation of, 115–18; early life of, 114; education of, 114–15; impact on investment industry, 113; on index funds, 128, 129–30, 312–13; index funds introduced by, 113, 123–25; on key elements to investing, 134; Malkiel on, 113, 125; Morgan's relationship with, 119; on mutual funds, 116–18, 119–20; Perfect Portfolio of, 134–39, 312–13; publications of, 119–20, 126, 137, 139; Samuelson's relationship with, 113, 125–27; on sources of return, 132–34; stock market predictions of, 132–34; Vanguard created by, 123 (see also Vanguard Group); at Wellington Fund, 118–22
Bogle, William Yates, Jr., 114
Bogle, William Yates, Sr., 114
Bogle on Mutual Funds (Bogle), 126, 137
Bogle Sources of Return Model for Stocks (BSRM/S), 133
bonds: coupon reinvestment and, 209–10; domestic, Ellis and Malkiel on, 277; fundamental concepts about, 208–9; government, first, 7–8; immunization and, 213–15; Leibowitz and, 202, 203–13; Lekdijk Bovendams, 7–8; market for, during 1920s-1960s, 204–6; Treasury, Fama's predictability study of, 106–7
bond swaps, Leibowitz and Homer’s memorandum on, 211–12
bond trading market, birth of, 3
Boness, A. James, 152
Booth, David, 109
Boulding, Kenneth, 228
Bova, Anthony, 212; asset allocation and, 216–18; endowment model and, 220–21; publications of, 217
Brinson, Gary, 45, 46
British East India Company (EIC), 8
Brooklyn Dodgers, 175–76
Brown, Philip, 94
Brown, Robert, 83
Brownian motion, 83
Bubbles: causes of, 241–42; detecting, 242; earliest, purported, 9–13; Fama on, 243–46; in housing market, 247, 248–51; Kindleberger’s definition of, 241; reaction to Shiller’s observation that stock market was in, 242–43; Shiller’s definition of, 241; unique culture of, 241
Buffett, Warren, 15, 219, 279; on derivatives, 164; will of, 112
Bulow, Jeremy, 158
Busby, Steve, 264
Buser, Stephen, 338n40
Bush, George H. W., 236
business cycles, Siegel’s interest in connection between stock market and, 286–88
Cagan, Phillip, 283
call options, in ancient Greece, 4–5
Campbell, Jean, 10
Campbell, John, 231, 237, 246–47
Canaday, Woody, 264
“Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk” (Sharpe), 66–67
capital asset pricing model (CAPM): accessibility of investing and, 68; alternative versions of, 69–72; coining of term, 342n37; contradictory results and, 100–101; development of, 62–66; efficient market hypothesis and (see efficient market hypothesis (EMH)); Fama-French results and, 101–3; fundamental insights of, 76–78; implementation of, 68; key assumption of, 47–48; origins of, 61–62; reception of, 67–68; Sharpe’s Perfect Portfolio and, 311; starting point for, 51; tests of, 99–100, 345n54
“The Capital Asset Pricing Model: Some Empirical Tests” (Black, Scholes, and Jensen), 148
Capital Ideas (Bernstein), 23
Capitalism and Freedom (Friedman), 284
Cardano, Girolamo, 15
Carhart, Suzanne, 174
cars, Merton as enthusiast of, 176, 193–94
Case, Karl, housing price index of, 247–51
“Case for the Mutual Fund Management” (Bogle under pen name Armstrong), 119–20
Case Shiller Weiss, Inc. (CSW), 248, 250
Center for Research in Security Prices (CRSP), 90, 158, 201
“The Challenge of Central Banking in a Democratic Society” (Greenspan), 237–39
“Challenge to Judgment” (Samuelson), 125
Chambers, David, 16
Chartered Financial Analyst (CFA) designation, 261
charting, 88, 89
Chicago Board of Options Exchange (CBOE), 160
Chicago Mercantile Exchange (CME), 251
China: early bronze coins in, 5; early paper currency in, 6
Cisco, 297
Citigroup, 302, 346n5
The Clash of the Cultures: Investment vs. Speculation (Bogle), 139
Cochrane, John, 111, 235–36, 336n34
Cohen, Abby Joseph, 236–37
INDEX

coins: bronze, Chinese, 5–6; earliest, 4
Common Stocks as a Long Term Investment
(Smith), 292
compound returns, Scholes on, 167–68
Compustat database, 109
“Computerized Approaches to Bond Switching” (Williamson), 207
Concordia Res Parvae Crescunt, 14–15
Constantinides, George, 157
Continuous-Time Finance (Merton), 180
“Convergence of Risks” (Leibowitz and Bova), 217
convexity risk, Scholes on, 167–68
Cootner, Paul, 146; options pricing work of, 151, 152; The Random Character of Stock Market Prices, 83
“The Corporate Tax Cut” (Ellis), 260
Cosmos (TV series), 201
cost matters hypothesis (CMH), 130–32
Cowles, Alfred, III, 21, 22, 37
Cowles Commission for Research in Economics, 20–21, 22–23
Cramer, Jim, 77
Credit Suisse First Boston, Merton Model and, 185
Curry, Stephen, 98
cyclically adjusted price-to-earnings (CAPE) ratio, 246–47; Siegel’s concern about, 301–2
Dantzig, George, 40, 339n57
databases, Fama’s use of, 109
Debreu, Gerard, as Nobel Prize winner, 22
“Decentralized Investment Management” (Sharpe), 74
defined contribution plans, Merton on, 194–97
de Finetti, Bruno: portfolio theory and, 35–36; Sam Savage’s relationship with, 339n57
Demosthenes, 5
derivatives: in ancient Greece, 4–5;
Black-Scholes/Merton option-pricing formula and, 159–63; Buffett on, 164; financial crisis of 2007–2009 and, 166; first, 3; information contained in, 161; Leibowitz and Homer’s memorandum on bond swaps and, 211–12; Merton on, 189–92; Merton’s empirical investigation of warrant pricing model and, 180.
See also options
Deutsche Bank, Merton Model and, 185
diagonal model, 40, 58–61
Dilworth, J. Richardson, 258
Dimeco, Sallyann, 85
Dimensional Fund Advisors (DFA), 109, 315–16; Fama’s association with, 110; Merton as director of, 189; retirement planning and, 193, 196, 197
Dimson, Elroy, 16
D-I-V Directive, 306
diversification: Bogle on, 137–38; early, 13–15; Ellis and Malkiel on, 277; Leibowitz on, 223–24; Markowitz on, 32–33, 309–10; Markowitz’s mathematical formulation of, 44; modern portfolio theory and (see modern portfolio theory (MPT)); Shiller on, 252; volatility and, 218
dividend discount model, 232
dividends, Fama’s research on, 109
Dodd, David, 23
Donaldson, Lufkin & Jenrette, 160; Ellis’s employment at, 260–62; Merton’s consulting work with, 187
Donaldson, William H., 260
“Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends?” (Shiller), 232–33
dragon risk, 221
drawdown, Scholes on, 168
Drexel Burnham Lambert, 236–37
Duffie, Darrell, 190
duration targeting, 214–15
Dutch East India Company, 8–9

For general queries, contact webmaster@press.princeton.edu
Econometrica, 37, 71
“The Economic Role of the Investment Company” (Bogle), 116
Economics: An Introductory Analysis (Samuelson), 114, 126, 228
Economics: finance vs., 34–35; financial, as emerging field, 144
Eendragt Maakt Magt, 14
efficient market hypothesis (EMH), 93–99; adaptive markets hypothesis and, 320; advocates of, 82; cost matters hypothesis compared with, 130–31; critics of, 82; debate over, 97–98; expansion of concept, 98–99; Fama on market efficiency and crashes and, 245–46; Jensen on, 81; joint hypothesis problem and, 96–97; LeRoy and Porter on, 234–35; random walks and, 82–83; rationality and, 83–84; Shiller on, 82, 97, 232–36; versions of, 94–96, 97
efficient portfolios, 32
Einstein, Albert, 83, 227
The Elements of Investing (Ellis and Malkiel), 276
Ellis, Charles (Charley), 255–80, 323; on active management, 267, 276; on avoiding making mistakes, 265–66, 278; connections to other pioneers, xiv; on diversification, 277; on domestic bonds, 277; at Donaldson, Lufkin & Jenrette, 260–62; early life of, 255–56; education of, 256–57, 259–60; on financial advisers, 280; on goal setting, 267; Greenwich Associates and, 262–64; on index funds, 266, 274–76, 277, 279, 318; Perfect Portfolio of, 276–80, 318; on performance investing, 261–62, 273–74; publications of, 255, 260, 261–62, 264, 266–67, 272–73, 274–75; relationship with Swensen, 270–71; at Rockefeller Brothers, 258–59; on savings, 276, 278–79; on taxes, 279; “ten commandments” for individual investors and, 268–69; truths about investing and, 267–68; on underperformance, 272–73; Yale University endowment fund and, 269–71
Ellis, Harold, 260
endowment funds, 5
endowment model, 220–21
Endowment Model of Investing: Return, Risk, and Diversification (Leibowitz, Bova, and Hammond), 220
Enterprise Fund, 117
equity premium, Siegel on, 288–91
Ernst, Harry, 85
exchange-traded funds (ETFs): Markowitz on, 310; Sharpe on, 311; Siegel on, 304–5; traditional index funds vs., 136–37
expected utility theory, 20
Explorer Fund, 135
Extraordinary Popular Delusions and the Madness of Crowds (Mackay), 9
Extraordinary Tennis for the Ordinary Tennis Player (Ramo), 264–65
Fama, Eugene (Gene), 81–112, 189, 305; academic career of, 87–88; on active management, 112; agency problem and, 108–9; asset predictability and, 105–7; association with Dimensional Fund Advisors, 110; beta and, 101–3; breadth and depth of contributions to finance profession, 107–11; on bubbles, 243–46; on capital asset pricing model versions, 70–71; connections to other pioneers, xiv; database use by, 109; dissertation of, 87, 88; dividends research of, 109; early life of, 84; education of, 84, 85–87; former students of, 109–10; key influences on, 86–88; as Nobel Prize winner, 243, 244; Perfect Portfolio of, 111–12, 312; publications of, 88, 93–94, 108; relationship with Thaler, 245; sports interest of, 84–85; stock split research of, 90–93; on students at Chicago, 143; three-factor model of, 102–5
Fannie Mae, 249
fat-tail events, 89–90
INDEX

Faulstich, Ginny, 231

Fear Index. See Volatility Index (VIX)

Federal Reserve, Greenspan as chairman of, 236–39

fees: Ellis on, 274; Sharpe on, 79–80

fiat currency: Chinese bronze coins as, 6; first full-scale use in Europe, 11

finance: behavioral (see behavioral finance); economics vs., 34–35; mathematical, Merton’s work in, 180

financial advisers: Ellis on, 280; Sharpe on, 78; Shiller on, 253

Financial Analysts Journal, papers to celebrate sixtieth anniversary of, 218

financial crises: Minsky’s model of, 240–41; of 2007–2009, derivatives’ role in, 166

financial district, earliest known, 3

financial economics, as emerging field, 144

Financial Engines, 75

financial goals: achieving, investments and, 332; levers to help in achieving, 331–33; setting, Ellis on, 267; size of, 332

financial innovations, Shiller on, 253–54

financial science, Merton and, 186–87

First Index Investment Trust, 113, 123, 124

Fischer, Stanley, 178

Fiserv, 248

Fisher, Irving: on stock market in 1929, 15–16; The Theory of Interest, as Determined by Impatience to Spend Income and Opportunity to Invest It, 15

Fisher, Lawrence, 90, 147, 158

Foo, Justin, 16

Ford, Henry, 227

forward exchange rate, Siegel on, 284–85

Foundations of Economic Analysis (Samuelson), 178

Foundations of Finance (Fama), 108

Freddie Mac, 249–50

Freeman, Harold, 178

French, Ken, 97, 291; beta and, 101–3; three-factor model of, 102–5

Friedman, Lawrence, 201

Friedman, Milton, 20; on index funds, 347n46; influence on Siegel, 283–84; Markowitz’s thesis defense and, 34–35; as Nobel Prize winner, 22; publications of, 20, 284; relationship with Siegel, 285

Friedman, Rose, 285

Fryer, Sarah, 202, 215–16

The Future for Investors: Why the Tried and the True Triumphs over the Bold and the New (Siegel), 298–300, 305

futures contracts. See derivatives

Garber, Peter, on early bubbles, 10, 12, 13

Gauss, Carl Friedrich, 42

General Motors, Merton’s investment in, 176

General Reinsurance Corporation, 163–64

The General Theory of Employment, Interest, and Money (Keynes), 15, 16, 17, 132

Gibbons, Michael, 158

Glaeser, Edward, 248

goals. See financial goals

Goldman Sachs, Merton Model and, 185

government bonds: first, 7–8; precursor to, 7

Graham, Benjamin, 15, 23, 275

Graham and Dodd Scroll Award, Siegel as winner of, 289

Grant, Ulysses S., Jr., 256

Grantham, Jeremy, 348n46

Great Depression, investment theories and, 15–16

Greece, ancient, derivatives contracts in, 4–5

Greenspan, Alan: Black Monday and, 236–37; as chairman of Federal Reserve, 236–39; irrational exuberance speech of, 237–39

Greenwich Associates, 262–64

Griswold, Merrill, 114

growth traps, Siegel on, 298–300

Grundfest, Joe, 75

Gutfreund, John, 187, 354n56

Hamada, Robert, 342n36

Hammond, Brett, endowment model and, 220–21

For general queries, contact webmaster@press.princeton.edu
INDEX

Hancock, Peter, 193
Hansen, Lars, 285
Harkness method of education, 256
hedging, Merton on, 182–83
Heller, Walter, 177
Hershey Company, 200
Hicks, John, 15
Hipkins, Josephine Lorraine, 114
Hirshleifer, Jack, 55
Homer, Sidney, 288; bond price volatility and, 211; bond swaps and, 211–12; collaboration with Leibowitz, 206, 208, 209–12; impact of bond return assessment and, 210–11; Leibowitz’s relationship with, 202–3
“In Honor of the Nobel Laureates Robert C. Merton and Myron S. Scholes: A Partial Differential Equation That Changed the World” (Jarrow), 190–91
housing market bubbles, 247, 248–51
housing price index of Shiller and Case, 247–51
Hume, David, influence on Markowitz, 19
Hunt-Leonx globe, 357n59
Hutzler, Morton, 203
Ibbotson, Roger, 46
IBM, growth trap and, 298–99
IBM 7090, first, 341n21
immunization, 213–15
“Index-Fund Investing” (Samuelson), 127
Index Fund of America, 347n46
index funds: attempts at forming, 347–48n46; Black-Scholes-Jensen collaboration and, 146; Bogle on, 128, 129–30, 312–13; correlation structure of, 170; disdain for, 124; Ellis on, 266, 274–76, 277, 279, 318; Fama’s advocacy of, 113; Friedman on, 347n46; introduced by Bogle, 113, 123–25; Malkiel’s advocacy of, 277; Scholes on, 314; Sharpe on, 77, 113, 311; testing of technical feasibility of, 127–28; traditional, exchange-traded funds vs., 136–37; Vanguard Group and (see Vanguard Group)
The Index Revolution (Ellis), 274–75

For general queries, contact webmaster@press.princeton.edu
John von Neumann Theory Prize, Markowitz as winner of, 336n6
joint-stock companies, modern, first, 8–9
*Journal of Finance*, 27
JP Morgan, Merton Model and, 185
Kahneman, Daniel, 42, 83–84
Kamstra, Mark, 253, 254
Kaplan, Paul, on Markowitz’s contribution to portfolio construction, 44
Katona, George, 228
Ketchum, Marshall, 23, 338n40
Keynes, John Maynard, 283, 320; Cambridge University endowment managed by, 16–17; lack of impact on investing, 17; publications of, 15, 16, 17, 132; on sources of return, 132
Kindleberger, Charles, 240–41
Klein, Lawrence, as Nobel Prize winner, 22
Klingenstein, J. K., 259
KMV, Merton Model and, 185
Kogelman, Stanley, 212, 214
Koopmans, Tjalling, 20–21; association with Marschak, 20–21; linear programming and, 26–27, 40; as Nobel Prize winner, 22
Kritzman, Mark, 45
Kurosawa, Akira, 308
Langetieg, Terry, 214
Law, John, 10–11
Law, William, 10
law of the average covariance, 40–41
LeBaron, Dean, 348n46
Leibowitz, Martin, 199–225; alpha and, 218–20; asset allocation and, 216–18, 223–24; asset-liability management and, 213–15; awards and recognition received by, 199–200; bond price volatility and, 211; bonds and, 202, 203–13; bond swaps and, 211–12; collaboration with Homer, 206, 208, 209–12; connections to other pioneers, xiv; early life of, 200; education of, 201, 202; endowment model and, 220–21; impact of bond return assessment and, 210–11; at Morgan Stanley, 216; operations research work of, 201–2; Perfect Portfolio of, 221–25, 316–17; publications of, 199, 201, 209, 212, 213–14, 217, 218–19, 220–21; relationship with Homer, 202–3; on risk, 216–18, 220–21, 224, 316–17; at Salomon Brothers, 204–13; at TIAA-CREF, 215–16
Lekdijk Bovendams bonds, 7–8
Leontief, Wassily, 179
LeRoy, Stephen, 234–35
Leuthold Group, 125
Levite, Gertrude, 281
Lewis, Michael, 354n56
liability-driven investing, Leibowitz’s work in, 213–15
Liar’s Poker (Lewis), 354n56
Liber de Ludo Aleae (The Book on Games of Chance) (Cardano), 15
Lieberman, Gerald, 201
Liew, John, 110
Lincoln, Robert, 256
linear programming, 26–27, 40
Lintner, John, 70–71
Litzenberger, Robert, tribute to Sharpe, 75
Lo, Andrew, 320
Locke, John, 333
Long-Term Capital Management (LTCM), 158, 188–89
Lorie, James, 90, 147, 158, 201
Los Angeles Dodgers, 176
“The Loser’s Game” (Ellis), 255, 264
Lucas, Robert E., Jr., 344n28
Lufkin, Dan, 260
MacAvoy, Paul, 183
MacBeth, James, 99–100, 143
Mackay, Charles, 9
Maclachlan, Fiona, 38
MacroShares, 250–51
Mahovlich, Frank, 350n4
Mahovlich, Pete, 350n4
For general queries, contact webmaster@press.princeton.edu
Merton, Robert C. (Bob) (continued)
Merton, Robert K., 173, 174; Matthew effect and, 35
Merton Model, 185–86
Mesopotamia, ancient loans in, 2–3
“Metaphysical Considerations Involved in Choosing a Measure of Effectiveness” (Leibowitz), 201
Metcalf, Jeff, 86
Millennium Bubble, 241
Miller, Merton, 86–87; as Nobel Prize winner, 7; Scholes and, 144; The Theory of Finance, 108; Treynor and, 69
Minsky, Hyman, 240–41
Mississippi Company, 11
MIT-Penn-SSRC model, 229
modern portfolio theory (MPT):
contributors to, 35–37; establishment in the investments industry, 45–46; foreshadowing of, by Marschak, 38–39; of Markowitz, 35–39; Markowitz’s process for developing, 41–42; portfolio risk formula and, 25–26
Modigliani, Franco, 93, 146; Merton and, 181; as Nobel Prize winner, 22, 146, 229, 283; as Shiller’s dissertation advisor, 229; Treynor and, 69
money: functions of, 4; time value of, 2. See also coins; fiat currency; paper currency
Montreal Canadiens, 141
Morgan, Walter L.: Bogle’s relationship with, 119; as Wellington Fund founder, 119
Morgan Guaranty Trust Co., 124
Mossin, Jan, 71
“The ’Motionless’ Motion of Swift’s Flying Island” (Merton), 176

“Murder on the Orient Express: The Mystery of Underperformance” (Ellis), 272–73
Murphy, Antoin, 12
mutual funds, 114–16; Bogle on, 116–18, 119–20; costs to consider when owning, 131; first, 14–15, 114–15; Go-Go funds, 117, 120, 121; open-end, first, 15; options-based, first, 187
Myers, Stewart, 146
Nasdaq, Siegel’s call of market top and, 297
net present value calculation, 5
New Normal Bubble, 241
New York Giants, 175–76
New York Yankees, 175
Nicholas Molodovsky Award, received by Leibowitz, 199–200
Nobel Prize in Economics, formal name of, 326n7
Nobel Prize in Economics winners: Arrow as, 22, 179; Debreu as, 22; Fama as, 243, 244; Friedman as, 20, 22; Hansen as, 285; Kahneman as, 83; Klein as, 22; Koopmans as, 22; Leontief as, 179; Lucas as, 344n28; Markowitz as, 22, 37–38, 75; Merton as, 148, 158, 173, 174, 283; Miller as, 75; Modigliani as, 22, 146, 229, 283; Prescott as, 230, 288; Samuelson as, 83, 228, 283; Sargent as, 230, 344n28; Scholes as, 109, 148, 158, 174; Sharpe as, 39–41, 75; Shiller as, 83, 243, 283; Simon as, 22; Sims as, 230; Solow as, 283; Thaler as, 83, 245, 290; Tobin as, 22, 231; Vickrey as, 174–75
Nobel Prize in Physics winners: Rainwater as, 174; Steinberger as, 174
Nobel Prize in Physiology or Medicine winner, Theiler as, 174
Nokia, 314
Nolan, Michael, Jr., 132
Nothaft, Frank, 249–50
one-factor model, 58–61
open-end mutual funds, first, 15
operations research, Leibowitz's work on, 201–2

“Optimal Composition and Deployment of a Heterogeneous Local Air-Defense System” (Leibowitz and Lieberman), 201

option-pricing model. See Black-Scholes/Merton option-pricing formula

option pricing technology, application of, 156

options: call, in ancient Greece, 4–5; Chicago Board of Options Exchange and, 160; first options-based mutual fund and, 187; Merton on trading, 181–84; Merton's work on pricing, 173–74; trading as reason for, 352n60; Treynor's research on pricing, 149–50. See also Black-Scholes/Merton option-pricing formula

overvaluation: Shiller on, 303–4; of technology sector, Siegel on, 295–98

Ownership Society Bubble, 241

paper currency, 6

passive management: advocates of, 321; Scholes on, 147

path to the Perfect Portfolio, 323, 331–33

pension managers, 214


performance investing, Ellis on, 261–62, 273–74

Pfleiderer, Paul, 158

Phillips Exeter Academy, 256

Pierce, Franklin, 256

Porter, Richard, 234–35

“Portfolio Analysis Based on a Simplified Model of the Relationships among Securities” (Sharpe), 56

portfolio management: future of, 50; Markowitz's interest in, 24; pioneers of, overview of, ix–xi. See also specific topics

“Portfolio Operations” (Ellis), 262

portfolio risk formula, Markowitz's discovery of, 25–26

“Portfolio Selection” (Markowitz), 27–34

portfolio selection: importance of Markowitz's contribution to, 44–45; Markowitz's book on, 39–41; as Markowitz's dissertation topic, 27–34; work preceding Markowitz's work on, 35–39

Portfolio Selection: Efficient Diversification of Investments (Markowitz), 39–41, 54

portfolio theory, Marschak and, 35

Portfolio Theory and Capital Markets (Sharpe), 73

Pre-Pottery Neolithic period trade, 1–2

Prescott, Edward, 230, 288–89

prestito, 7

price-earnings (P/E) ratio, 246, 291; cyclically adjusted (see cyclically adjusted price-to-earnings (CAPE) ratio); equity premium and, 291; lower-risk premiums and, 238; Shiller on, 303; Siegel on, 297–98, 299, 302, 303, 305, 306, 307; speculative return and, 133–34; target, in 1719 France, 11

price-to-earnings (P/E) multiple, of Mississippi Company, 11

“The Pricing of Options and Corporate Liabilities” (Black and Scholes), 157

Primecap Fund, 135

Primerica, 346n5

principles of constructing a Perfect Portfolio, 323–26
process of constructing a Perfect Portfolio, 323, 326–31
prospect theory, 42–43
pure yield pickup swaps, 211
Qin Shi Huangdi, 5
Rainwater, James, as Nobel Prize winner, 174
Ramo, Simon, 264–65, 362n14
RAND Corporation, 39, 340n77
The Random Character of Stock Market Prices (Cootner), 83
A Random Walk Down Wall Street (Malkiel), 276
random walks, 82–83, 88–89, 93–94
“Random Walks in Stock-Market Prices” (Fama), 93–94
Rashomon effect, 308
rate anticipation swaps, 211
rational expectations, 344n28; Shiller on, 229–30, 232–34
“Rational Expectations and the Structure of Interest Rates” (Shiller), 230
rationality, critics of, 83–84
Reagan, Ronald, 236
rebalancing, Bogle on, 135–36
“Religion and Science” (Einstein), 227
reputation, importance of, 3–4
retirement, baby boomer, Siegel on effect on investor portfolios, 299–300
retirement planning: asset-liability management and, 214–15; inflation and, 224; Merton’s work in, 192–93, 194–97; Sharpe’s interest in, 75–76; target date funds for, 224
risk: adaptive markets hypothesis and, 320; capital asset pricing model and (see capital asset pricing model (CAPM)); differing approaches to, 321; dragon, 221; Ellis on, 268; endowment model and, 220–21; Leibowitz on, 216–18, 220–21, 224, 316–17; MacroShares and, 251; Markowitz on, 25–26, 310; Merton on, 192–93; portfolio risk formula and, 25–26 (see also modern portfolio theory (MPT)); Scholes on, 167, 171–72, 313–14; Sharpe’s expansion on Markowitz’s approach to, 56; Siegel on, 294–95. See also beta
“Risk, Interest Rates and the Forward Exchange” (Siegel), 284
Risk-Return Analysis: The Theory and Practice of Rational Investing (Markowitz), 50
Roberts, Harry, 86–87
Rockefeller, David, Jr., 256
Rockefeller, John Davison (Jay), IV, 256
Rockefeller Brothers, Inc., 258
Roll, Richard, 90, 109, 143
Rose, June, 176
Rosenberg, Barr, 46, 100
Ross, Steve, 215
Roy, A. D.: modern portfolio theory and, 35, 37, 38; “Safety First and the Holding of Assets,” 37
Rubinstein, Mark, 35, 41, 44
“Safety First and the Holding of Assets” (Roy), 37
Sagan, Carl, 201
Salomon, Arthur, 203
Salomon, Herbert, 203
Salomon, Percy, 203
Salomon Brothers, 203; Leibowitz at, 204–13
Salomon Brothers & Hutzler, 203
Samsonite Corporation, 348n46
Samuelson, Paul: Bogle’s relationship with, 113, 125–27; Brownian motion and, 83; Merton’s relationship with, 178–79, 187; as Nobel Prize winner, 83, 228, 283; option pricing technology application and, 156; publications of, 113, 114, 125, 126, 127, 178, 228; on Shiller’s dissertation committee, 230; warrant pricing model of, Merton’s empirical investigation of, 180
San Francisco Giants, 176
Sanitary Can Company, 346n5
Sargent, Thomas, as Nobel prize winner, 230, 344n28
Savage, Leonard Jimmie, 20, 36; Brownian motion and, 83; influence on Markowitz, 20; “The Utility Analysis of Choices Involving Risk,” 20
Savage, Sam, 44, 339n57
savings: achieving financial goals and, 332; Ellis on, 276, 278–79; Malkiel on, 226
Schkolnick, Meyer R., 174
Scholes, Myron, 95, 109, 140–72; academic career of, 145–46, 157–58; on active management, 170–71, 314; on Buffett’s view of derivatives, 164–65; caution regarding index funds, 314; as Center for Research in Security Prices director, 158; collaboration with Black, 146, 147–48 (see also Black-Scholes/Merton option-pricing formula); connections to other pioneers, xiv; consulting work of, 146–48, 159; dissertation of, 144–45; early life of, 141–42; education of, 142–45; first meeting of Black, 146; first options-based mutual fund created by, 187; on information in stock prices vs. options market, 163; interest in programming, 144; Jensen’s collaboration with, 146, 148; Long-Term Capital Management founded by, 158, 188; Merton and, 181; as Nobel Prize winner, 109, 148, 158, 174; option pricing model and (see Black-Scholes/Merton option-pricing formula); Perfect Portfolio of, 166–72, 313–14; publications of, 148, 156–57; on risk, 167, 171–72, 313–14; as Salomon Brothers managing director, 158
Schwert, Bill, 106, 107–8, 110–11, 287, 292
Security Analysis (Graham and Dodd), 23 security market line, 64–65. See also capital asset pricing model (CAPM)
Sharpe, William F. (Bill), 46, 51–80, 158, 199, 347n46; academic career of, 72–73; “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk,” 66–67; capital asset pricing model of (see capital asset pricing model (CAPM)); connections to other pioneers, xiv; consulting work of, 72, 73–74; “Decentralized Investment Management” address of, 74; diagonal (market) model of, 58–61; dissertation of, 41, 56; early years of, 52; education of, 52–53, 54–56; elected president of American Finance Association, 74; expansion on Markowitz’s approach, 56; Financial Engines cofounded by, 75; interest in retirement planning and investing, 75–76; interest in transfer prices, 55; Litzenberger’s tribute to, 75; mentors of, 54–55; as Nobel Prize winner, 39–41, 75; Perfect Portfolio of, 78–80, 311–12; principles of good financial advice of, 78; programming skills of, 53–54; publications of, 56, 61–62, 73, 74; at RAND, 53–54; reward-to-variability measure of, 74; William F. Sharpe Associates established by, 74
Sharpe ratio, 74
Shiller, Robert (Bob), 226–54, 292; academic career of, 230–31; on bubbles, 241–43; connections to other pioneers, xiv; cyclically adjusted price-to-earnings ratio and, 246–47; dissertation of, 230; on diversification, 252; early life of, 227–28; education of, 228–30; on efficient markets, 82, 97, 232–36; on Fed leadership’s expression of opinions about market, 237–40; on financial advisers, 253; on financial innovations, 253–54; housing price index of, 247–51; interest in economics, 228; MacroShares and, 250–51; market timing and, 252–53, 318; as Nobel shareholding companies, oldest, 8
Shiller, Robert (Bob) (continued)
Prize winner, 83, 243, 283; on overvaluation of stock market, 303–4; Perfect Portfolio of, 251–54, 317–18; on price-earnings ratio, 303; publications of, 230, 232–33, 249, 301; on rational expectations, 229–30, 232–34; relationship with Siegel, 300–301; on tulip bubble, 9; unconventional nature of, 231–32

Siegel, Bernard, 229, 239, 281–307; academic career of, 285–86; on asset allocation, 295, 306–7; on baby boomer retirement effect on investor portfolios, 299–300; connections to other pioneers, xiv; on cyclically adjusted price-to-earnings ratio, 301–2; dissertation of, 283–84; early life of, 281–82; education of, 282–83; on equity premium, 288–91; on exchange-traded funds, 304–5; on forward exchange rate, 284–85; on growth traps, 298–300; guidelines to successful investing, 305; on overvaluation of stock market, 303; Perfect Portfolio of, 305–7, 318–19; on price-earnings ratio, 297–98, 299, 302, 303, 305, 306, 307; publications of, 229, 281, 283–85, 288–95, 296–300, 305–6; relationship with Friedman, 285; relationship with Shiller, 300–301; on risk, 294–95; on technology sector overvaluation, 295–98; at WisdomTree Investments, 304

Siegel’s Paradox, 284–85
Simon, Herbert, 22
“A Simplified Model for Portfolio Analysis” (Sharpe), 61–62
Sims, Christopher, 230
Singer Corporation, Merton’s investment in, 176
single-index model, 58–61
Sinquiefield, Rex, 46, 109
smart beta, Ellis on, 274
SmartNest, 189
Smith, Edgar Lawrence, 292
Smith, Harrison, 124
Société des Moulins de Bazacle, 8
Solow, Robert, 283
South Sea Company, 11–13
S&P/Case-Shiller Home Price Index, 248–51
speculation, investing vs., Markowitz on, 33–34
Sprengle, Case, 152
“Stability of a Monetary Economy with Inflationary Expectations” (Siegel), 283–84
Standard & Poor’s (S&P), 248, 251
Standard Oil of New Jersey, growth trap and, 298–99
Steinberg, Jonathan (Jono), 304
Steinberg, Saul, 304
Steinberger, Jack, 174
Stewart, Ian, 148
Stigler, George, 166
stock market: bubbles in (see bubbles); business cycles and, Siegel’s interest in, 286–88; cyclically adjusted price-to-earnings ratio and, 246–47; Fed leadership’s expression of opinions about, 237–40; irrational exuberance and, 237–39; Shiller/Siegel controversy over overvaluation of, 302–4; Trump’s election and, 301
stock market crashes: of Black Monday (October 19, 1987), 236–37; Fama on, 245; of 1929, Bogle family and, 114
Stocks for the Long Run (Siegel), 229, 281, 289, 291–95, 300, 305–6
stock splits, Fama’s research on, 90–93
Strange, Robert, 258
“Studies in the Theory of Risk Bearing” (Mossin), 71
Stulz, René, 108, 110–11
substitution swaps, 211
swaps, Leibowitz and Homer’s memorandum on, 211–12
Swensen, David, 219, 269, 270–71
target date funds, 224
Target Date Retirement Income Funds, 196, 197
INDEX

399
taxes, 48, 322; Bogle on, 135; corporate, 1964

cut in, 260; Ellis on, 279
technical analysis, 88, 89
technology sector overvaluation, Siegel on,
295–98
terminal wealth, Scholes on, 167
Tesler, Lester, 87
Texas Instruments calculators, 161
Thaler, Richard (Dick): on equity premium,
290; on market efficiency, 245; as Nobel
Prize winner, 83, 245, 290; publications
of, 245; relationship with Fama, 245
Thales of Miletus, 4–5
Theiler, Max, as Nobel Prize winner,
174
The Theory of Finance (Fama and Miller),
108
The Theory of Interest, as Determined by
Impatience to Spend Income and
Opportunity to Invest It (Fisher), 15
The Theory of Investment Value
(Williams), 15, 23, 28
“The Theory of Speculation” (Bachelier), 83
Thorndike, Doran, Paine & Lewis,
121
three-factor model, 102–5
Three P’s of Investments, 322–23
time value of money, 2
timing: achieving financial goals and, 332;
market timing and, 318
Timmons, Bruce, 228
Tobin, James, 22, 39, 231
“To Get Performance, You Have to Be
Organized for It” (Ellis), 261	

tokens, for ancient record keeping, 2
Toronto Maple Leafs, 141
traditional index funds (TIFs), exchange-
traded funds vs., 136–37
transfer prices, Sharpe’s interest in, 55
Treasury bills, Fama’s predictability study
of, 105
Treasury bonds, Fama’s predictability study
of, 106–7
Treasury Inflation-Protected Securities
(TIPS), 193, 197, 198, 311, 322
Trente demoiselles de Geneve, 13–14
Trehnor, Jack, 69–70, 347n46; “Market
Value, Time, and Risk,” 69; research on
option pricing, 149–50
trills, 253–54
Trump, Donald, Siegel and Shiller’s views
on stock market effects of election of,
301
tulip bubble, 9–10
Tversky, Amos, 42, 83
Twain, Shania, 141
Twardowski, Jan, 127
underperformance, Ellis on, 272–73
Ur, financial district of, 3
Uspensky, J. V., 25
“The Utility Analysis of Choices Involving
Risk” (Savage and Friedman), 20
“The Utility of Wealth” (Markowitz), 43
Value and Capital: An Inquiry into Some
Fundamental Principles of Economic
Theory (Hicks), 15
value investing, 15
Vanguard 500 Index Fund, 123
Vanguard Group, 305; costs of index funds
of, 131–32; creation of, 122, 123; evolution
of, 113–14; fees of, 114; first index fund
created by, 124–25, 126; growth of, 128–30;
incorporation of, 123; initiation of no-load
distribution system by, 127–28
Van Horne, James, 158
van Ketwich, Abraham, 14
variance bounds, 358n26
variance of returns, Markowitz on, 29–32
Varney, Stuart, 297
Velde, Francois, 12
Vereenigte Ost-Indische Compagnie
(VOC), 8–9
Vickrey, William, 174–75
Vitale II Michiel, 7

For general queries, contact webmaster@press.princeton.edu
volatility, diversification and, 218
volatility drag, Scholes on, 167–68
Volatility Index (VIX), 162, 172, 352n66
volatility tests, 358n26
Volcker, Paul, 214, 236
von Neumann, John, influence on Markowitz, 20

Walsh, Nellie, 256
warrant pricing model, Merton’s empirical investigation of, 180
Watts, Ross, 143
Webster, Daniel, 256
Weiss, Allan, 248, 250–51
Wellington Fund, 119–22, 135; under Bogle’s management, 120–22; merger with Ivest Fund, 121–22
Wells Fargo: index funds and, 124; Scholes’s consultation for, 147–48
Wells Fargo Investment Advisors, 347–48n46
Weston, Fred, 54, 55, 56, 338n40, 341n11
WGBH, 257
William F. Sharpe Associates, 74
Williams, Charlie, 260

Williams, John Burr: influence on Markowitz, 24–25, 41; The Theory of Investment Value, 15, 23, 28
Williamson, Peter, 207
Windsor Fund, 135
Winning the Loser’s Game (Ellis), 266–67
WisdomTree Investments, 304
Wissner, Len, 215
Wolfson, Mark, 158
Woodrow Wilson National Fellowship Foundation, 282
Woolley, Leonard, 3

Xerox, 186

Yale University: Dutch bond holding of, 8; Ellis’s involvement with endowment fund of, 269–71
Yield Book, 205, 206, 209
York Cone Company, 200
Young, Timothy, 8

Zhenzong, Emperor, 6
Zweig, Jason, 261