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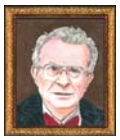
STEP 2
Nobel Laureates

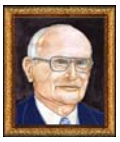


"Sooner than I dared expect, my explicit prayer has been answered. There is coming to market... something called the First Index Investment Trust... offering extremely low portfolio turnover; and best of all, giving the broadest diversification needed to maximize mean return with minimum portfolio variance and volatility." Newsweek magazine, August 1976; Also, "It is not easy to get rich in Las Vegas, at Churchill Downs or at the local Merrill Lynch office."

- Paul A. Samuelson, Nobel Laureate in Economics, 1970, Massachusetts Institute of Technology

"Properly measured, the average actively managed dollar must underperform the average passively managed dollar, net of costs. Empirical analyses that appear to refute this principle are guilty of improper measurement."

- William F. Sharpe, Nobel Laureate in Economics, 1990, "The Arithmetic of Active Management," 1991



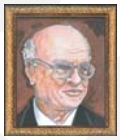
"We next consider the rule that the investor does [or should] consider expected return a desirable thing and variance of return an undesirable thing."

- Harry Markowitz, Nobel Laureate in Economics, 1990, "Portfolio Selection," 1952

"Question: ...how do you think people should invest for the future..? Should they buy index funds?

Answer: Absolutely. I have often said, and I know this will get some of your readers mad, that any pension fund manager who doesn't have the vast majority—and I mean 70% or 80% of his or her portfolio—in passive investments is guilty of malfeasance, nonfeasance or some other kind of bad feasance! There's just no sense for most of them to have anything but a passive investment policy."

- Merton Miller, Nobel Laureate in Economics, 1990, *Investment Gurus*, 1990



"Question: So investors shouldn't delude themselves about beating the market? Answer: They're just not going to do it. It's just not going to happen."

- Daniel Kahneman, Nobel Laureate in Economics, 2002, Orange County Register, "Investors Can't Beat Market," 2002

2.1 INTRODUCTION

Step 2: Become aware that Nobel Prize winners researched the market.

Welcome to Step 2 where we discuss the evolution of modern finance and the contribution of Nobel laureates and others.

A review of the collective research of Nobel Prize recipients and other academics shows a sharp contrast between what the average active investor understands about investing and the conclusion of 300 years of unbiased, rigorous, and empirical research conducted by academics. The fact is: that body of research discredits the conventional Wall Street wisdom that a stock picker armed with enough knowledge and research can consistently beat the market. Once active investors accept this fact, they are on the road to recovery. Although this step is titled "Nobel Laureates," numerous academics who have researched the stock market, but have not been awarded a Nobel Prize will also be discussed.

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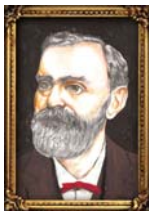
2.2 DEFINITIONS

2.2.1 Nobel Prize in Economic Sciences


Alfred Nobel

The Nobel Prize is an international award given annually since 1901 for achievements in physics, chemistry, medicine, literature and peace. The award is perhaps the most globally recognized honor in each of the fields in which it is presented. Receipt of the prize is the culmination of a rigorous nomination process. Each year category committees send individual proposals to thousands of scientists, academy members, and university professors in numerous countries, asking them to nominate Nobel Prize candidates for the coming year. Nominations received by each committee are then evaluated with the help of specially appointed experts. Once these committees have made their selection among the nominated candidates, and presented their nominations to the prize-awarding institutions, a vote is taken for the final choice of Nobel Prize laureates. It was in 1968 that the Bank of Sweden instituted the Prize in Economic Sciences in Memory of Alfred Nobel, founder of the Nobel Prize. The Nobel Prize in Economic Sciences is awarded to works ranging from methodologies and theories used in studying the efficient use of economic and financial resources to microeconomic performance and economic policy, development economics, and international trade. The prize is subject to the same rigorous nomination process as those awarded in the other Nobel categories.

2.2.2 The University of Chicago, the Center for Research in Security Prices, and the Stock Market Database

In addition to Nobel laureates who have studied the stock market, thousands of academics are also performing market research. The University of Chicago is the premiere institution of learning in stock market research. For years the University has been recognized as a leader in financial research. To be sure, as of 2004, 23 of the 58 Nobel Laureates in Economics attended or taught at the university. This is an impressive 40% of all Nobel Laureates in Economics. (Harvard University boasts the second largest number with four recipients.) Why is the University of Chicago so often an incubator for Nobel Prize laureates?

The answer to this question lies within the historical evolution of stock market research, which received a significant boost at the end of the 1950s. In 1959, Louis Engel, then vice president of Merrill Lynch telephoned Professor James Lorie of the University of Chicago to ask


University of Chicago Hall of Nobel Laureates

him if anyone knew how well most people performed in the stock market relative to other investments. The question so intrigued Lorie that he proposed that Merrill Lynch fund a project with the sole purpose of gathering the prices, dividends, and rates of return of all stocks listed on the New York Stock Exchange. Lorie used the new capabilities offered by computers to develop a database to maintain accurate securities information over time. The project's ultimate goal was to create a complete and accurate database so that researchers would no longer be required to compile their own data.

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To that end 1960, the Center for Research in Security Prices (CRSP) was established at the University of Chicago with a $300,000 grant from Merrill Lynch to house the massive data gathering project. Thankfully, since its creation, the center has received an abundant amount of support. For instance, from 1964 to 1986, it received gifts in excess of $1 million from individuals yearning for stock market information.

Computer Lab, Circa 1960

Lorie was the center's first director, a position he held until 1975. He, along with his colleague, Lawrence Fisher, a former associate professor of finance who became the associate director of CRSP, faced the monumental responsibility of researching the accuracy of each piece of stock information they collected.

The stock market database was completed in 1964 when between two million and three million pieces of information was successfully entered. Lorie and Fisher analyzed total return, dividends received, and changes in capital as a result of price changes of all common stocks listed on the NYSE from 1926 to 1965. The research found that the rate of return on common stocks listed on the NYSE averaged 9%. For the first time in history, an average rate of return could actually be measured. The findings were published in *The Journal of Business* and the front page of *The New York Times's* financial section heralded the pair's results.

However, the research did not really answer Engel's original question. But, a recent study by Dalbar did. The study measured the average investor's performance in the market, and found it to be significantly below the market average. Over a 20-year period ending in 2004, the average equity investor only earned about 3.7% per year while the S&P 500 gained 13.2% per year. Inflation averaged 3% per year during this period. Active investors also pay about 2.5% of their portfolio value in taxes each year. That equals a loss of about 2% a year for the average equity investor.

For its part, CRSP continues to accumulate data on a regular basis. With a $180,000 grant from Dimensional Fund Advisors (DFA) in 1984, data dating from January 1972 from NASDAQ markets was added. "If I had to rank events, I would say this one (the original CRSP Master Fuel) is probably slightly more significant than the creation of the universe," said Rex Sinquefield, formerly co-chairman and currently a director of DFA. "The entire field of finance has been changed and developed through that database."

In 2003, Professor Eugene Fama was appointed director of CRSP. Fama is famous for his use of CRSP data to determine the dimensions of stock returns. Fama is also on the board of directors and the director of research for DFA.

2.3 PROBLEMS

2.3.1 Investors Rely on Lady Luck

The biggest problem investors face today is their continued reliance on information sources other than empirical research, like the research collected at CRSP, when selecting their investments. Investors often speculate, rely on Lady Luck, market time, and chase recent successes of managers, stocks and investment styles. As opposed to following the expertise of Nobel laureates, they blindly wander into the beckoning arms of active managers who dominate Wall Street walk-

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ing right past the financial academics, who could offer them the one thing active managers cannot—unbiased, rigorous and empirical research that will guide them to a risk-appropriate, tax-managed, and highly efficient portfolio of low-cost index funds.

2.3.2 Active Investors are Unaware of Academic Studies

Unfortunately, the great majority of investors are unaware of the tremendous amount of academic brain and computer power that has been applied to investing. This lack of awareness makes investors more susceptible to the siren songs of active management.

There is a stark contrast between a peer-reviewed and non-biased academic research paper and an article in *The Wall Street Journal*, *Barron's*, *Forbes*, *Fortune*, *Money Magazine*, an analyst's report or numerous other sources of investment research. Unfortunately, virtually all private investors are unaware of the vast amounts of academic research that points to investing in portfolios of index funds.

2.4 SOLUTION

Nobel Laureates and Academics

The solution to this lack of awareness on the part of investors is for them to take a quick look at the history of modern finance. It's a story that began nearly 350 years ago, and will hopefully lead recovering active investors to a more rational and profitable way to invest. If you are interested in further exploring the academic studies that have impacted modern finance, see the list of supplemental readings in Appendix C.

1654 The Early Attempts to Quantify Risk

Modern finance began with the realization that risk needed to be measured and managed. The intelligent management of risk can be traced to 1654 during the Renaissance Period.

It was a time of great discovery when centuries-old beliefs were constantly under question and reevaluation by intellectuals. This time of rebirth challenged the wizards, mystics, seers, fortunetellers, oracles, and soothsayers that were previously regarded as experts at predicting the future.

Blaise Pascal

In 1654, a French gambler named Chevalier de Mere and a mathematician named Blaise Pascal tried to predict the future outcome of a game of chance. They wanted to determine how to divide up the stakes of an unfinished game when one player was slightly ahead. So, they developed the Theory of Probability.

This theory, which states that the values of future outcomes will depend on the expected value and the variance around the expected value, is the basis for the concept of risk management and modern finance. Centuries later in 1952, Nobel laureate Harry Markowitz embraced what a French gambler questioned in 1654, and converted it into the Theory of Portfolio Selection. His idea revolutionized the investment process.

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1690 Beginning to Understand Risk Management


Edmund Halley

Edmund Halley, the famous English astronomer who discovered Halley's Comet, began work on a series of life tables in early 1690. A probability-based life expectancy could be derived from these tables, which later became the blueprint for the life insurance industry. Techniques of risk management were improved over the years, leading to one of the first commercial applications by the English government. Government officials developed life expectancy tables and sold life annuities, which were soon followed by marine insurance products. Halley's work ultimately led to the founding of Lloyd's of London, which originated in Edward Lloyd's coffee house, a small shop that Halley frequented. Lloyd, who owned the coffee shop, overheard Halley and started the insurance company. The same principles of managing risk were later applied to the stock market.

1730 The Bell-Shaped Curve


Abraham DeMoivre

Abraham de Moivre tutored students in mathematics and served as a resident statistician at Slaughter's Coffee House in London. There, gamblers paid him to calculate their odds. In 1697, the Royal Society elected him a member. De Moivre became friends with Isaac Newton and astronomer-physicist Edmund Halley.

He later pioneered and developed analytic geometry and the Theory of Probability, culminating in his published book, *The Doctrine of Chance* in 1718. Included in the book were problems with dice and other games as well as a definition of statistical independence. With Newton, de Moivre studied the normal distribution curve and found the normal curve was the limit for the binomial curve. The discovery of standard deviation and the bell-shaped curve in 1730 was a critical element in the development of risk management.

1830 The Prudent Man Rule

Judge Samuel Putnum

Judge Samuel Putnum, in a case of the alleged improper management of a trust account, handed down a decision now known as the "Prudent Man Rule." This rule is used today to establish proper guidelines for trustees. Judge Putnum declared, "Do what you will, the capital is at hazard. All that can be required of a trustee to invest is that he shall conduct himself faithfully and exercise a sound discretion. He is to observe how men of prudence, discretion, and intelligence manage their own affairs, considering the probable income as well as the probable safety of the capital to be invested." This was one of the first authoritative and clear statements to convey that risk had to be considered as well as return.

1900 The Birth of the Random Walk Theory


Louis Bachelier

The year 2000 marked the centennial of the Random Walk Theory of stock market prices. Surprisingly, one hundred years after the theory's conception, 90% of investors are still not convinced that the markets move in a random fashion. Many scholars confirmed and refined the research of Louis Bachelier, the seldom recognized hero of financial economics. In 1900 Bachelier published his doctoral thesis titled "The Theory of Speculation," and presented it to the faculty of the Academy of Paris. In his

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thesis, Bachelier anticipated much of what has become a standard among financial economic theories: the random walk of stock market prices. One of his ground breaking conclusions was "there is no useful information contained in historical price movements of securities."

As is typical with great minds, Bachelier's professors and contemporaries did not appreciate his innovation. His thesis received humiliating marks from his professors casting him into the shadows of the academic underground. After a series of minor posts, he ended up teaching in an obscure French town for much of the rest of his life. His valuable work was largely ignored until the mid-1960s when economist, Paul Samuelson, stumbled upon it in a library in France.

In 1964 MIT Professor Paul Cootner published a 500-page collection of research reprints on the randomness of the market titled "The Random Character of Stock Market Prices." The work contained the first full text English translation of Bachelier's thesis. Cootner said of Bachelier: "So outstanding is his work that we can say that the study of speculative prices has its moment of glory at the moment of its inception."

The Cowles Commission, Colorado Springs, CO, 1937
Photo courtesy of the Cowles Foundation

So, exactly how does the Random Walk Theory apply to modern finance? The theory describes the way stock prices change unpredictably as a result of unexpected information appearing in the market. This "random walk" of changing prices has created a misconception among investors that stock prices change randomly for no rational reason. The reason stock prices are random is because the news that moves the prices is unpredictable and random. News is inherently unpredictable or it would not be considered news. In reacting rationally to new information, the stock prices look as though they behave in a random fashion. Many other academics including Paul Samuelson, Robert Merton, Eugene Fama, Fischer Black, Myron Scholes, and Burton Malkiel later expanded on Bachelier's work.

1932 The Basis for the Standard & Poor's 500 Index

Alfred Cowles

Alfred Cowles was a wealthy Chicagoan whose father and grandfather had been major stockholders and executives of the Chicago Tribune Company. As a young man, Cowles was struck with tuberculosis. His illness prompted him to move to Colorado Springs to seek treatment. Cowles remained in Colorado for 10 years. During his time there he began to help his father manage the family's finances. To keep up with financial and market news, Cowles subscribed to a number of investment services. After the inability of these services to predict the stock market crash of 1929, Cowles became disillusioned with them. So, he decided to analyze the ability of stock market forecasters to choose a portfolio that succeeded in beating a market average or index. To that end, Cowles reviewed approximately 12,000 recommendations and four years of transactions by 20 leading fire insurance companies. He published his results in a July 1933 article titled "Can Stock Market Forecasters Forecast?" His conclusion: "It is doubtful." Cowles' extensive study of stock mar-

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ket data provided an early demonstration of the "random walk" in stock price movements, and the beginning of the Efficient Market Hypothesis. Cowles published a follow-up study in 1944, reviewing 6,900 market forecasts over a period of 15.5 years. Once again, he concluded there was no evidence supporting the ability of the forecaster to predict the future of the market.

In keeping with his newfound realization that market movements cannot be predicted, Cowles founded the Cowles Commission for Research in Economics in 1932. The commission's motto: Science is measurement. The purpose of the commission was to foster the development of logical, mathematical and statistical methods of analysis for application in economics. However, its location in Colorado made it difficult to find a qualified director. So, the commission moved to the University of Chicago in 1939. The commission's move to Chicago ignited a spark in the city that eventually transformed it into a powerhouse of stock market research. Later, the commission moved to Yale University in 1955 where it was renamed the Cowles Foundation. To its credit, almost every U.S. winner of the Nobel Prize in Economics has spent time at the Cowles Foundation.

The Cowles Foundation was just one of the many contributions Cowles made to stock market research. In addition, he created a market index, which became the basis for today's Standard & Poor's 500 Index. His goal was to establish a stock market index to represent the average experience of stock market investors. Cowles determined that despite his research and the research of countless others after him, investors would continue to listen to market forecasters because they wanted to believe that somebody, anybody, could predict the future.

1952 Efficient Diversification

Harry Markowitz

Don't bet the ranch. Get more bang for your buck. Maximize output relative to input. Nothing ventured, nothing gained. Diversify instead of striving to make a killing. Don't put all your eggs in one basket; if it drops, you're in trouble. High volatility is like putting your head in the oven and your feet in the refrigerator.

These common sense sayings capture the essence of Harry Markowitz's brainstorm, which was ignited one afternoon as he sat in the University of Chicago's library reading a book about current theories of stock market investing. Markowitz thought investors should be as concerned with uncertainty or the risk of investments as they were with the return of investments. Thirty-eight years later, this innovative, practical theory earned him the 1990 Nobel Prize in Economics. This landmark contribution to the investment world was first published in 1952 in an essay titled "Portfolio Selection." He later authored a book titled *Portfolio Selection: Efficient Diversification of Investments*.

The book presented a theory for optimal investment in stocks that differs in regard to their expected return and risk. Investment managers and academic economists have long been aware of the necessity of taking both risk and return into account. Markowitz's primary contribution was his development of a rigorously formulated operational theory for portfolio selection under uncertainty. His theory evolved into a foundation for further research in financial economics. Markowitz was the first to place a number on risk relative to investing. Risk was previously discussed in general terms and based more on feeling or intuition. He quantified the "undesirable thing" investors try to avoid by using a

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range of possible return outcomes based on the past variability of returns.

Under certain conditions, Markowitz showed that an investor's portfolio choice can be reduced to balancing two dimensions: the expected return on the portfolio and its variance or standard deviation. The risk of a diversified portfolio depends not only on the individual variances of the return on different assets, but also on the opposite movement of all assets. When one asset class goes up, another goes down. The opposite movement results in a higher return than if all of the assets go up or down together. "Diversification is both observed and sensible. A rule of behavior, which does not imply the superiority of diversification must be rejected both as a hypothesis and as a maxim," said Markowitz.

In addition, Markowitz made the distinction between the risk of an individual stock and the risk of a portfolio. He showed how individual risky stocks lose much of their risk if combined with less risky stocks in a portfolio. What is remarkable about Markowitz's discovery is that an investor can reduce the volatility of a portfolio and increase its return at the same time.

When Markowitz began to formulate his ideas in the 1950s, leading investment guides recommended that an investor should find one stock with the highest expected return, invest in it, and ignore all the others. If investing involved no amount of risk, holding investments with the highest expected returns would be a highly profitable idea. The experienced investor knows that investing is full of risk. Risk essentially means that there is uncertainty in future outcomes. People do not expect to be in an auto accident, but they invest in auto insurance because of the unpredictable possibilities. People also do not expect a stock in their portfolio to decrease in price, but it will at some point. If an investor's portfolio is diversified, than the loss incurred from that one stock will be "insured" by other stocks that do not decrease in price. Markowitz knew that in the real world investors are not only interested in return; they are also concerned with risk.

Markowitz concluded that risk is central to the whole process of investing. He then wondered how to measure the appropriate amount of risk investors should undertake. Markowitz came to realize the cruel truth of investing: investors cannot earn higher returns without taking on greater risk, and the greater the risk the greater the possibility of losing. So, he set out to devise ways to help investors apply trade-offs between risk and return. Using mathematics to solve the puzzle, Markowitz discovered a remarkable new way to build an investment portfolio, which he called the "efficient portfolio." The efficient portfolio offers an investor the highest expected return for any given level of risk or the lowest level of risk for any given expected return.

1958 The Separation Theorem

James Tobin

James Tobin contributed the concept of combining risk-free assets, such as cash or low risk bonds, with risky assets such as stocks. His paper titled "Liquidity Preference as Behavior toward Risk" appeared in *The Review of Economic Studies* in February 1958. The paper focuses on the Separation Theorem. This theory claims that Markowitz's approach of selecting stocks for the most efficient risky portfolio is separate from the choice to divide up the total portfolio between risky and risk-free assets. Based on various combinations, investors could have a choice of numerous levels of overall risks in their portfolios, Tobin concluded. (The various index portfolios found in Appendix A offer 20

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levels of risk for globally diversified portfolios.) Tobin also performed an analysis of financial markets and their relationship to expenditure decisions, debt decisions, employment, production, and prices.

1958 The Modigliani-Miller Theorems


Frank Modigliani


Merton Miller

The Modigliani-Miller theorems concern decisions about aspects of the accumulated savings stock. The basic model was formulated in Modigliani and Miller's joint essay titled "The Cost of Capital, Corporation Finance and the Theory of Investment" written in 1958. Using this basic model, Miller and Modigliani derived two so-called invariance theorems, now known as the MM theorems—two letters well-known among financiers.

The main message of the MM theorems is that a firm's value is unrelated to its dividend policy, and that policy is an unreliable guide for stock selection. Additionally, they state that an investor's expected return is equal to a company's cost of capital. The MM theorems have become the comparative norm for theoretical and empirical analysis in corporate finance. When designing strategies for tax-managed portfolios, dividend paying stocks are eliminated and the MM theorems indicate that these criteria should alter expected returns.

1964 The Capital Asset Pricing Model or Risk / Return Model


William Sharpe

The Capital Asset Pricing Model (CAPM) defines risk as volatility relative to the market and states that a stock's cost of capital and an investor's expected return is proportional to the stock's risk relative to the entire stock universe.

In the mid-1960s, several researchers worked independently of one another to contribute to the CAPM. William Sharpe's pioneering achievement in this field is contained in his essay, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," published in 1964.

CAPM finds that the expected return of an asset is determined by its beta coefficient—a means of measuring the volatility of a security or portfolio of securities in comparison with the market as a whole. CAPM also measures the similarities between the return on the asset and the return on the market portfolio.

CAPM is the backbone of modern price theory for financial markets. Widely used in empirical analysis, the model allows an abundance of financial statistical data to be utilized systematically and efficiently. It is applied extensively in practical research and has become an important tool for decision making in different areas. Indeed, research often requires information about a firm's cost of capital where the risk premium is an essential component.

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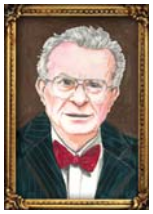
1965 Proof That Prices Fluctuate Randomly



Paul Samuelson

Paul Samuelson's findings can be summarized as follows: Market prices are the best estimates of value, price changes follow random patterns, and future stock prices are unpredictable.

Samuelson was the first American to win the Nobel Prize in Economics. His famous textbook titled *Economics*, published in 1948 is now in its 13th edition. Samuelson is considered by some to be the most famous economist of our time. His wisdom is reflected in his own words, "Investing should be dull, like watching paint dry or grass grow. If you want excitement, take $800 and go to Las Vegas. It is not easy to get rich in Las Vegas, at Churchill Downs or at the local Merrill Lynch office."

One of Samuelson's idols was Louis Bachelier, the unappreciated genius who first wrote about random prices over a century ago. Samuelson discovered Bachelier's paper from 1900 in a library in France. Like many others, Samuelson proved, expanded, and refined Bachelier's discovery. In Samuelson's 1965 paper titled "Proof that Properly Anticipated Prices Fluctuate Randomly," he describes "shadow prices" or true values of a security. Samuelson suggests that the best estimate of the true value of a security is the price that is set in the marketplace every minute of every trading day. Although these prices may not be the precise true value, no other estimate is likely to be more accurate than what buyers and sellers agree on in the marketplace.

Some investment professionals disagree with this position. They contend that there are constant differences between the market price and the true value of securities, and that those differences can result in future profits for the skilled money manager. However, Samuelson insists there are no easy pickings and no sure gains. Generally speaking, Samuelson has contributed more than any other contemporary economist to raising the analytical and methodological level in economic science.

1965 Efficient Market Theory

Eugene Fama

As expected from a University of Chicago graduate and professor, Eugene F. Fama is another pillar of modern finance. Building on the ideas of Bachelier, Cowles, Samuelson, and many others, Fama set out to develop a comprehensive theory to explain why stock market prices fluctuate randomly. He also coined the famous phrase "Efficient Market."

Fama worked for a stock market newsletter firm while an undergraduate at Tufts University in Boston. One of his duties at the firm was to find, buy and sell signals based on certain market trends. It was then that he experienced firsthand the difficulty in predicting future market trends. He began to wonder, just as Cowles did before him, why it was so difficult to translate what appeared to be neatly defined past trends into sure methods of making money in the stock market.

These ponderings influenced him enough to attend the University of Chicago, obtain his doctorate, and become a professor teaching classes on the works of Harry Markowitz. Despite the innovative character of Markowitz's writings and his association with Chicago, his work was virtually unknown when Fama first brought it to the attention of the finance department of the University of Chicago. Fama later applied his

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extensive, world famous research to create numerous index mutual funds at DFA.

In January 1965, *The Journal of Business* published Fama's entire 70-page doctorate dissertation, "The Behavior of Stock Market Prices." The research was summarized nine months later by *The Financial Analysts Journal* and titled "Random Walks in Stock Market Prices." In his dissertation, Fama suggests that by utilizing the tremendous resources that a major brokerage firm can gather for researching industry trends, effects of interest rates and accounting data, and by talking to managers of firms, consulting economists and politicians, a security analyst should be able to consistently outperform a randomly selected portfolio of securities of the same general risk. Since in any given situation, an analyst has a 50% chance of outperforming the random selection, even if his skills are nonexistent, Fama's conclusion was that analysts do not consistently outperform a market.

The Efficient Market Theory explains the workings of free and efficient financial markets. The theory states that information about stocks is widely and cheaply available to all investors and all known and available information is already reflected in current stock prices. The price of a stock agreed on by a buyer and a seller is the best estimate, good or bad, of the investment value of that stock, it says. Stock prices will almost instantaneously change as new unpredictable information about them appears in the market. All of these factors make it almost impossible to capture returns in excess of market returns without taking greater than market levels of risk, the theory holds.

It is relatively rare to find and profit from a mismatch between a stock's price and its value or to identify an undervalued or overvalued stock through fundamental analysis of stocks. This creates efficient financial markets where most stock prices accurately reflect their true underlying investment values. Even when stock prices do not reflect their values, the cost of corrective action is greater than the profit gained from such actions.

The Efficient Market Theory threatens the view that there might be something pinning down the average price of an asset. Deviations of an asset price from this value follow a random walk, the theory asserts. This position annoys those who claim they can anticipate speculative trends in asset prices. The theory clearly states that those individuals can not beat a market because any available information is already incorporated in the price.

However, at a 1968 Institutional Investor conference, one irate money manager insisted that what he and others did for investors had to be worth more than just throwing darts at *The Wall Street Journal*. The "dart board portfolio" soon became a new benchmark for active investors, appearing in newspapers, magazines, and in a 1992 20/20 ABC news segment titled "Who Needs the Experts?" In that segment, a giant wall-sized version of *The Wall Street Journal* was transformed into a dartboard. Reporter John Stossel threw several darts as he described the firms he randomly hit. The results of that portfolio were compared to those of major Wall Street experts. The darts beat 90% of the experts! When ABC requested interviews with several of these experts, none would speak or comment on their humiliating inability to beat the darts.

The Random Walk Theory of stock market prices was detected as early as 1900 by Louis Bachelier and revisited in later studies by Holbrook Working, Alfred Cowles, Clive

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Granger with Oskar Morgenstern, and Paul Samuelson. But, it was Fama who took the theory to new heights with enough rigorous statistical analysis to shake up Wall Street.

1965 Active Management Put to the Test


Michael Jensen

Eugene Fama's graduate student, Michael Jensen, published "The Performance of Mutual Funds in the Period 1945-1964" in *The Journal of Finance* in 1965. This was the first study of actively managed mutual funds to document the failure of investment professionals to outperform the appropriate market indexes.

Jensen also added a risk dimension when comparing mutual fund performance. He adjusted returns of funds using Sharpe's volatility measure, beta. This incorporated the idea that investors who take more risk should receive a higher return. Over performance or underperformance of an index may be due to exposure to more or less risk than a comparable index. Jensen found that if investors had held a broadly based portfolio of common stocks at the same risk level as mutual funds, they would have earned 15% more. Only 26 out of 115 funds outperformed the market over the period of the study.

Jensen's dramatic study opened the eyes of both the mutual fund industry and investors. He pointed out that fund managers have access to extensive research, and do their jobs every day with wide ranging contacts and associations in both the business and financial communities. This begs the question: if the experts cannot beat an index, who can?

1971 The First Index Fund

John McQuown joined the Wells Fargo Bank Management Science division in 1964. He was recruited by the division's president to implement modern portfolio theories in the bank's trust department. McQuown had learned of the existence of these new theories from three acquaintances at the University of Chicago—Fisher, Lorie and Fama. Although McQuown had a degree in mechanical engineering, he became more interested in applying computer science to the stock market. While working to revamp the trust department at Wells Fargo, he called on numerous academic consultants, including Markowitz, Sharpe, Fama, Miller, Lorie, Jensen, Scholes, Black and Jack Treynor.

Eventually, McQuown, along with his colleagues James Vertin and William Fouse, developed the first commercial product that actually applied the academic theories developed at the University of Chicago. That product was to become the first index fund.

In 1971, the son of the owner of Samsonite Luggage Corporation completed his graduate studies at the University of Chicago's Department of Finance. When he returned to Denver, he wanted to apply what he had learned to Samsonite's pension fund. His contacts in Chicago put him in touch with Wells Fargo Bank in San Francisco. As a result, Samsonite invested $6 million of its pension fund into the very first index fund. That first index fund was not based on the S&P 500, but comprised of an equal dollar amount of each of the 1,500 stocks on the New York Stock Exchange.

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1973 A Random Walk Down Wall Street


Burton Malkiel

In 1973, Burton G. Malkiel published his book, *A Random Walk Down Wall Street*, which clearly lays out several of the principles of the academic research described above. Malkiel's book presents these theories to the private investor. In addition, he calls on institutions to sponsor an index fund. A line in the book's first edition reads, "Fund spokesmen are quick to point out you can't buy the market averages. It's time the public can." Two years later on December 31, 1975, The Vanguard Group, a fledgling mutual fund firm, took Malkiel up on his call when it created the First Index Investment Trust. Malkiel joined Vanguard's board of directors in 1977. Vanguard's founder, John Bogle, has referred to him as the "spiritual leader of the crusade."

1973 The Standard and Poor's Composite Index Funds


Rex Sinquefield

John McQuown at Wells Fargo and Rex Sinquefield at American National Bank in Chicago established the first Standard & Poor's Composite Index Funds in 1973. Both of these funds were established for institutional clients; individual investors were excluded. Wells Fargo invested $5 million from their own pension fund in their index fund, while Illinois Bell invested $5 million of their pension fund assets in the index fund managed by American National Bank.

In 1981, McQuown joined the board of directors of DFA. Benefiting from McQuown's input, DFA further developed index-based investment strategies. For its part, Wells Fargo sold its index operation to Barclays Bank of London, which now operates as Barclays Global Investors and has become one of the world's largest money managers.

1975 The First Index Mutual Fund


John Bogle

John Clifton Bogle graduated from Princeton University in 1951, where his senior thesis included the sentence, "Mutual funds can make no claims of superiority over the market averages." Bogle is best known for launching the first index mutual fund for individual investors. Bogle claims his inspiration to start the fund came from three sources, all of which confirmed his 1951 research - Paul Samuelson's 1974 paper, "Challenge to Judgment," Charles Ellis' 1975 study, "The Loser's Game," and Al Ehrbar's 1975 *Fortune* magazine article on indexing.

Bogle founded The Vanguard Group in 1974; it is now the second largest mutual fund company in the world. Vanguard has 140 mutual funds for U.S. investors, 40 more funds for non-U.S. investors and assets totaling $1.1 trillion. When Bogle started the First Index Investment Trust on December 31, 1975, it was scoffed at by many in the industry, and labeled "Bogle's Folly." It was even regarded as un-American because it sought to achieve the stock market average return rather than insisting that Americans had to play to win. This first index mutual fund, which tracks the Standard & Poor's 500 Index, was later renamed the Vanguard 500 Index Fund. It started with comparatively meager assets of $11 million, but crossed the $100 billion milestone in November 1999, an astonishing growth rate of 50% per year. Bogle predicted in January 1992 that it would very likely surpass the Magellan Fund and become the industry's largest fund before 2001. In 2000, Bogle's prediction became a reality.

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1981 A New Frontier of Investing


David Booth

David Booth who graduated from the University of Chicago in 1971 was fortunate enough to be exposed to such great minds as Eugene Fama, Merton Miller, and Kenneth French. In the years before starting his own company, Booth eventually believed that people were missing the importance of the market efficiency story.

After familiarizing himself with 25 years of scientific research, Booth became convinced that academic studies gave investors an advantage. Understanding the vital relationship between risk and return was also facilitated by this academic approach.

So, in 1981, Booth made room in his two-bedroom apartment for a Quotron machine. Determined to explore new frontiers of investing, Booth, along with Rex Sinquefield, founded DFA. Booth continues to head operations as chairman, CEO and CIO of the company. DFA is one of the first in the investment community to impart the idea of equilibrium and the concept that the scientific method proves the direct relationship between risk and return.

The proof of this is in DFA's continued success, which was enjoyed even during the 1980's when small-cap stocks were at their worst. As of December 31, 2006, the firm managed $123 billion in assets.

1990 The Science of Investing is Recognized

On October 16, 1990, the Alfred Nobel Memorial Prize in Economic Sciences was awarded to Harry M. Markowitz of City University of New York, William F. Sharpe of Stanford University, and Merton H. Miller of the University of Chicago for their pioneering work in the field of financial economics.


William Sharpe


Merton Miller


Harry Markowitz

It was then that the science of investing was formally recognized marking a milestone by paying homage to the continuing revolution in investment theory and practice that was sparked nearly 40 years ago. All equally deserving, Sharpe was rewarded for the Capital Asset Pricing Model, beta and relative risk; Markowitz for the theory of portfolio selection; and Miller for work on the effect of a firm's capital structure and dividend policy on market price.

1992 The Three-Factor Asset Pricing Model


Eugene Fama


Kenneth French

In June 1992, Eugene Fama and Kenneth French of the University of Chicago published an article titled "Size and Book-to-Market Equity: Returns and Economic Fundamentals." Their research improved on William Sharpe's single factor asset-pricing model (CAPM). By identifying market, size, and value factors in returns, the two economists developed the Three-Factor Asset Pricing Model. This model is an invaluable tool for asset allocation and portfolio analysis that revolutionized the way portfolios are constructed and analyzed by identifying independent sources of risk and return. Fama and French introduced the first concentrated, empirical value strategies. The two

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economists updated their studies in 1998 to include data from as far back as 1929.

2.5 SUMMARY

The tumultuous stock markets contrast dramatically with the quiet academic libraries where dozens of academics created a revolution in investing. This body of academic research deserves to be a superior source of information for making decisions concerning investment portfolios. Random and efficient markets are an underlying theme throughout the bulk of the research.

Historically, the problem with getting this research out to the public was that no one had developed a way to convert it into a practical product. Thus far, the entire investment industry was profiting from the active trading of investment portfolios; even mutual funds, considered the everyman investment vehicle, were just large actively traded portfolios. The good news is: today there are index funds, that incorporate virtually all of the research described in this timeline.

2.6 REVIEW QUESTIONS

1. Who first proposed in 1900 that markets in which stocks are traded are basically random in nature?

   a. William Sharpe
   b. Louis Bachelier
   c. Eugene Fama
   d. Merton Miller

2. Modern Portfolio Theory is not so modern because Harry Markowitz first introduced one of the basic tenets in:

   a. 1654
   b. 1962
   c. 1952
   d. 1933

3. The three factors of Fama and French's Three-Factor Model are:

   a. interest rates, currency risk, and Federal Reserve policy
   b. company growth rates, earnings per share, analyst reports
   c. market, size, and value
   d. company industry, five-year sales growth rates, five-year earnings growth rates

4. Who was the first American to receive a Nobel Prize in Economics?

   a. James Tobin
   b. Paul Samuelson
   c. Harry Markowitz
   d. Merton Miller

5. Most Nobel laureates agree on how investors should invest their money. They recommend:

   a. allocate your portfolio among the top 10 technology stocks from last year
   b. invest in the top 12 mutual funds over the last five years
   c. since markets move randomly and are efficiently priced, diversify among global index funds
   d. buy Treasury bills

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