

Models for Investors in Real World Markets

JAMES R. THOMPSON

Noah Harding Professor of Statistics
Rice University

EDWARD E. WILLIAMS

Henry Gardiner Symonds Professor of Management
Rice University

M. CHAPMAN FINDLAY, III

Principal: Findlay, Phillips and Associates



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Models for Investors in Real World Markets

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To my wife, Ewa Majewska Thompson
James R. Thompson

To Susan, Laura, David, Garrett, Morgan, and Jacklyn
Edward E. Williams

To my wife, Beatrice Findlay
M. Chapman Findlay, III

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Preface

The bloom is off investment strategies based on *risk neutral probabilities*. Operating from their famed trading room, the Black Box, the “wise men” at Enron acted like holders of higher truth derived from sacred scrolls. Lesser beings who could not comprehend the soundness of Enron’s strategy simply assumed they were *missing something* and went along. The result was the largest bankruptcy in American history, with tens of thousands thrown out of work and wondering what happened to their Enron-based 401k plans. The Big Five accounting firm of Andersen had some explaining to do as to how it had failed to question six straight years of highly imaginative Enron bookkeeping. At the writing of this book, it is unclear whether Enron’s executives will be able successfully to hide behind a combination of exotic mathematical models and exotic accounting practices to avoid criminal as well as civil prosecution. Again and again, we hear the *dies irae* of the market: “If it sounds too good to be true, it probably is.”

The collapse in 1998 of the Scholes-Merton backed Long Term Capital Management hedge fund should have given pause to those who take the efficient market based formulae for “fair prices” in options and derivatives as rigid laws. There should surely be some embarrassment to the neoclassical establishment in the obvious failure of a Black-Scholes based fund, one indeed conspicuously organized and consulted by Merton and Scholes, within six months of their having received the Nobel Prize for the discovery of the “law” used to manage the LTCM. And, indeed, some embarrassment should accrue to the neoclassical Chairman of the Federal Reserve Board, Alan Greenspan, who organized a \$3.5 billion bailout of the fund as if those who followed efficient market orthodoxy should be rescued when their religion proved (temporarily, no doubt) false. The discipline of the “free” market is not, apparently, to be suffered by all.

There is an old joke illustrating the difference between communism and capitalism:

Suppose you have two cows. Under communism, the government takes both from you, shoots one and milks the other, giving the milk to your neighbor who doesn’t work. Under capitalism, you sell one cow and buy a bull. Your herd multiplies and the economy grows. You sell the herd and retire on the income.

A revised version of this joke has recently been circulating on the internet. It goes as follows:

Under the new capitalism of Enron, Scholes-Merton, and LTCM, the following applies: You have two cows. You sell three of them to your publicly listed company, using letters of credit opened by your brother-in-law at the bank, then execute a debt/equity swap with an associated general offer so that you get all four cows back with a tax deduction for five cows. The milk rights of the six cows are transferred via an intermediary to a Cayman Island company secretly owned by the Chief Financial Officer who sells the rights to all seven cows back to your listed company. The annual report says the company owns eight cows, with an option on one more. The securities analysts buy your bull.

Now, do you see why a company (Enron) with \$62 billion in assets can be brought to the brink of bankruptcy? The fact that market analysts across the board tended to keep Enron as a "strong buy" almost until the time of its bankruptcy, explains the new market destabilizing skepticism of the investing public in accounting firms and stock analysts. If the highly respected Emperor Enron has no clothes, then what about all the other potentates of the market?

One might sympathize somewhat with Alan Greenspan rushing in to quell the loss of confidence which would have occurred had LTCM been allowed to go bust in 1998 by arranging a bail-out by a spectrum of brokerage houses and investment bankers. Had LTCM gone bust in 1998 the way Enron did in 2001, then the kind of investor paranoia which is devastating the market in 2002 would possibly have come earlier in 1998.

On the other hand, from the standpoint of the dollars involved, the crash of LTCM (a \$3.5 billion bubble) was an order of magnitude less significant than that of the \$62 billion Enron debacle in late 2001. Had nature been allowed to take its course with LTCM in 1998, it is likely that a general scrutiny of accounting practices might have precluded the devastating crash of Enron in 2001. Chairman Greenspan could have seen a natural dampening of "irrational exuberance" in 1998 had he simply let LTCM fail naturally. By bailing out LTCM on the one hand, and stifling investment capital on the other, it appears he acted with the wisdom one tends to associate with the economic planning of, say, Argentina.

Believers in free markets do not believe that all the players are honest. But they believe that allowing the market to work its will tends to weed out fictitious accounting practices and pyramid schemes sooner rather than later. Amidst all the Congressional inquisitions being carried out against the managers of Enron and its accounting consultants, nobody is likely to point the finger of accusation toward the Chairman of the Federal Re-

serve Bank. But by covering up the manageable LTCM brush fire, Alan Greenspan may well have facilitated the conflagration which has followed the collapse of Enron.

The world is a complex place, and economic theory does not admit, and probably never will admit, of the same precise models which characterize, say, mechanics or electromagnetic flux. Any market systematology which fails constantly to question and stress its models with “what if?” scenarios will almost surely bring about disappointment, sooner rather than later.

The general orthodoxy of derivative pricing is based on *risk neutral probabilities*. The dealer sells a derivative for such a price that risk is eliminated. Like a bookmaker in a horse race, he makes his money whichever horse wins, on trading commissions and the like. Persons who believe in such a world must stop their ears, lest they hear the continuing *memento mori*, “Enron! Enron! Enron!”

There is much to fault the current orthodoxy of neo-classical economists. For example, the assumption of security progression according to a geometric Brownian walk is hugely unrealistic. Such models do not realistically admit of a large (say 5%) 24-hour change in a stock price. Yet, in the real world changes of such magnitude happen to stock prices very frequently. If these random walk assumptions were really the whole story, then one could simply invest in a broadly based index fund and be confident that his/her capital would grow at the 10% long-term average which, indeed, the market demonstrates. An index fund would become an irresistible alternative to a savings account at the bank paying, typically, 5%.

Broadly based bear markets do happen, as the 2000–2001 collapse indicates. Such bear markets tend to make diversification an ineffective prophylactic. Hence, there is a price to be paid for putting money into the market. This price is *risk*. Whereas gain is easily defined as dividends plus stock price appreciation, risk is hard to grasp. The usual means of defining risk is based on *volatility*, which is some version of the time averaged standard deviation of the stock price. Harry Markowitz won a Nobel Prize for posing the portfolio selection problem as setting the volatility at the edge of the portfolio owner’s comfort zone, and then picking stocks which would maximize expected gain subject to the volatility constraint. The solution of the Markowitz portfolio problem in this age of fast computing is child’s play. However, as Peter Bernstein has made abundantly clear in his iconoclastic *Against the Gods: The Remarkable Story of Risk*,

risk $\neq$ volatility.

It is insufficient (or, rather, it should be insufficient) for a fund manager to claim that he is not to blame for the disastrous performance of the fund.

He had computer code to prove that he had followed Markowitz to the letter. It is not his fault if something (e.g., terrorism, Greenspan, the SEC) untoward had happened to the market.

Events such as the attack of terrorists on the United States on September 11, 2001, are excellent excuses for failed investments. How can one be expected to deal with such hits on the market? And the Osama bin Laden strike was only one of the more obvious causes of “bear glitches” on the market. So far as the market is concerned, the decision of Alan Greenspan dramatically to increase interest rates was probably a major cause of the high-tech crash in 2000.¹ Then there was the decision of the Federal Trade Commission to oppose mergers. It appears that companies advancing new technologies, as they seek for appropriate markets and applications, are particularly needful of the ability to create combinations and spinoffs. Stifling this ability causes a significant hit on the market.

The fact is that it is unwise for investors to assume that America is safe from enemies, foreign or domestic. Moreover, it is also unwise for investors to assume that their government will carry out uniformly intelligent economic policies. There is ample historical evidence to indicate that both assumptions are wrong. We cannot readily forecast wars or the ability of bureaucrats to make big blunders. But we should rely on the inevitability of both and, to the extent possible, make investments in the light of such inevitabilities. There are many ways one can characterize the security markets starting in the 1920s. Our research shows that geometric Brownian motion is only part of the story. A really significant part, which is not readily explained by Brownian walks, is the fact that bear markets appear to impact themselves rather quickly on the market. It is true that the market has grown at roughly a 10% compounded rate over this time period. However, if one looks at the years of movement on the exchanges, it is almost as though the major indices behaved like an insured bank account in a country subject to random devaluations of the currency. That is, in years in which no bear hits on the index occur, the market grows very much. Investors over longer periods of time, have the advantage of the fact that in roughly 70% of the years, the index of large cap U.S. stocks rises rather than falls. And there is the further encouraging news that in over 40% of the years, the index has risen by over 20%. In 30% of the years, the market rises by over 25%. And in 25% of the years, the index has risen by over 30%. Over the roughly 75-year period such records have been kept, the United States has lived through the Great Depression, the Second World War, the Cold War, Korea, Vietnam, assorted massive sociological changes, shifts toward

¹The most recent collapse was probably caused by a large increase in the monetary base (in 1999) in anticipation of Y2K. This undoubtedly fueled the bubble, which then burst when the monetary base was restored to more normal levels.

and away from free markets, and assorted epidemics.

For general bear movements across the market, a portfolio of stocks will not spare the investor from the decline. The manner in which bear declines occur is, of course, a matter of disagreement. There are many rules of thumb which might be followed. We will largely use the following one: 10% declines in the market occur, on the average, once a year. Larger declines (say 20%) occur, on the average, once every five years. We do not know precisely when these across the board declines will disturb our expected upward progress. But we know that they are very likely to happen with a fairly predictable frequency and make our plans accordingly. The prudent investor has two weapons for the diminution of risk. The first is diversification across a broad sector of the stock market. This will protect against Enrons that go bad. The second is time. That will protect against bear markets caused by terrorists, bureaucrats, and things that go bump in the night.

Laurence Siegel, treasurer of the Ford Foundation, defines risk rather forcefully, if imprecisely:

... risk is the possibility that, in the long run, stock returns will be terrible.

The fact is that volatility is not a good summary of risk. Its use as such enabled Markowitz to reduce portfolio design to a straightforward problem in constrained optimization. But, as the late John Tukey, Donner Professor of Statistics at Princeton and Associate Director of Bell Labs, reminded us a decade before Markowitz's portfolio optimization:

Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise.

For many years, analysts have tried to forecast the value of a particular stock at a time in the future. Generally speaking, this task has proved intractable. In this book, we are not forecasting the value of the stock at a future time. Rather we are forecasting a probability distribution of values of the stock at that future time. It might seem that such a task is even more hopeless than forecasting the stock value. Our experience indicates that, with a fast computer, the task is not hopeless at all.

We have also discovered that using a nonparametric resampling (not quite the same as the bootstrap) technique for forecasting the distribution of an index fund (based on the 75 years of the Ibbotson index) gives essentially the same results that one obtains using a geometric Brownian model (with parameters estimated from the same data base) for time periods beyond

one or two years. The concordance between the two dramatically different approaches would seem to be mutually supportive of the efficacy of both.

One of the contributions of this book is an intuitive definition of *risk*. We create a mechanism whereby the investor can put in assumptions that apply to a security's progression in time, and then view, say, one year out the probabilities of one's position being worth at least 150% of its current value or, say, less than 30% of its current value. We refer to this mechanism as *risk profile simulation*. The progression of a stock or portfolio is a *stochastic process*, that is, for any value of time, there is an associated probability distribution of portfolio values. We want to give the user the opportunity to view the entire gamut of what, given the model assumptions, can happen from the very good to the very bad with associated probabilities throughout. These time sliced displays of the probability distribution function associated with the model assumptions we term *simugrams*. In other words, we will not be proposing to show what can happen on the average, but the entire risk profile.

For longer term forecasting of the probability distribution function of a stock (say more than three years) the plain geometric model unpatched by the Poissonian add-ons may well be sufficient. However for short-term forecasts it may be less volatile than justified by realism. Rather than starting from scratch, we take the tact of "patching" the less than realistic albeit mathematically tractable models beloved by the believers in Efficient Market Theory, in the light of things that can go wrong with them, and thus bring about better (though never true) models. The mathematics of adding in factors such as Poissonian bear market jumps downward is complex, and we bypass the difficulties of running down closed-form solutions to, say, likelihood functions, by demonstrating how simulation can be used to answer pertinent "what if?" questions.

We now summarize briefly the contents of this book. In Chapter 1, we outline some of the basic institutional factors associated with how stock markets operate and raise questions about whether these markets are efficient. We suggest that, in an efficient market, there would be very little that an investor or securities analyst could do to provide superior (above average) returns for his or her own accounts or for those of clients. We imply that, if markets are perfectly efficient, it makes no sense to study a particular security or, for that matter, read the typical 800-page "Investments" textbook required in college undergraduate or graduate classes. Further, it makes little sense for professionals to acquire such designations as the CFA (Chartered Financial Analyst). All securities should be correctly priced at any time, and it should make no difference when or what stocks are purchased.

In Chapter 2, the reader is introduced to the basic concepts of utility the-

ory. The essence of utility analysis rests on the basic economic premise that people prefer more good things to less, and that a continued flow of good things will have increasingly reduced marginal value as larger quantities are enjoyed. The law of diminishing marginal utility underlies this conceptualization, and it gives shape to utility of income (wealth) functions that have positive first and negative second derivatives. Utility theory forms the cornerstone of portfolio theory, and is the underlying explanation for why most individual investors are presumed to be risk averse.

Chapter 3 illustrates why diversification is an important fundamental requirement of rational investment choice. The chapter begins by examining the traditional Markowitz constrained optimization model, which depends for its solution on notions of mean returns from individual stocks, variances of those returns, and covariance among the returns. We ultimately conclude that what is essentially a sound procedure (diversification) applied to a concept (risk) that is, at best, difficult to quantify, all put together with historical data, may have no relationship at all to the underlying facts in the future! Chapter 3 provides a better way of looking at risk through simugrams of future stock prices.

The materials in Chapters 4 and 5 provide a summary of the current theory as generally accepted in financial economics along with an extensive critique of that theory. Chapter 4 contains an explicit discussion of the capital asset pricing model (CAPM) and its more recently hatched cousin the arbitrage pricing model (APM). The chapter outlines various methods to make the CAPM and the APM operational, but leaves for Chapter 5 to provide a specific critique of both. It turns out that neither model is much accepted any place but in textbooks but there is nothing left to occupy the vacuum that remains if either (or both) models is (are) rejected. Chapter 5 is really a *coup de grace*, a stinging critique of modern financial economic theory. After one reads this chapter, it becomes clear that what is done in many investments textbooks really has no meaning, and it provides the rationale for *Models for Investors in Real World Markets*. We leave the chapter convinced that securities markets are not efficient and understand the need for a new approach for investing in the real world.

In Chapter 6, we examine the basic valuation equations derived by J.B. Williams seventy years ago. In this very simple model, the “value” of a security is simply the present value of the future income stream expected to be generated by the security in question. Since aspects of this model will appear at almost every turn in the work to follow, we reproduce it here.

$$P(0) = \frac{D(0)}{(1+r)^0} + \frac{D(1)}{(1+r)^1} + \frac{D(2)}{(1+r)^2} + \dots \quad (1)$$

$$= \sum_{t=0}^{\infty} \frac{D(t)}{(1+r)^t},$$

where

$$\begin{aligned} P(0) &= \text{Price (Value) today} \\ D(t) &= \text{Dividend } t \text{ years in the future} \\ r &= \text{Market's (investor's) required rate of return.} \end{aligned}$$

Next, we amplify these equations by assuming various probability distributions for the underlying variables (sales, expenses, earnings, dividends, etc.), and compute means and variances for them. We suggest that this sort of methodology could be used to generate price or “value” distributions where a given market (or individual) rate of return, r , is required. In this chapter, we do not specifically point out to the reader that this is essentially the methodology used by securities analysts from the 1930s at least until the early 1960s to determine “undervalued” stocks (those where the present value of the future income stream exceeds the existing market price) and “overvalued” stocks (those where the present value of the future income stream is less than the existing market price). Variations on this methodology are still used today by many analysts where the market rate of return, r , is taken from the capital asset pricing model (see discussion in Chapters 4 and 5).

In Chapters 7 and 8, we provide a detailed procedure for analyzing securities. Borrowing from concepts developed by Benjamin Graham and others from the 1930s to the 1960s, we take concepts that were often only verbally constructed and build a more quantitative framework for those who have the patience (and inclination) to study financial statements carefully. Some accounting background is useful for a thorough understanding of the materials in Chapters 7 and 8.

In Chapter 9, we examine the importance of compound interest and observe that growth is merely noisy compound interest. Albert Einstein once said that his theory of relativity was of no great particular significance in the overall scheme of the universe; but of compound interest he felt “now there is a truly important revelation.” Chapter 10 continues to develop our conceptualization of risk profiling and applies the idea to bundles of securities (called portfolios). We argue that looking at the expected (present) values of an investment in and of itself is seldom a good idea.

We introduce and analyze the options market in Chapter 11 as a way of considering the notion of risk. It is thus our view that a simple application of equation (1) will not allow an investor to make a rational choice. This

is an extremely important point since many modern-day analysts and investors try to make decisions using variations of the equation by discounting essentially an uncertain (in the sense used in Chapter 5) income stream by means of taking a discount rate from the CAPM. Since the notion of “risk” is specifically incorporated into the evaluation by assuming that risk can be determined by means, variances, and covariances of historical stock returns (see discussion of the CAPM in Chapter 4), we see why the procedure is inappropriate. In Chapter 11, we also reproduce the Black-Scholes-Merton option pricing equation and suggest some serious problems associated with its “search” for risk neutrality. Confining oneself to looking only at mean values from a geometric Brownian walk model is reckless in the extreme. One must develop more realistic models and examine the entire realm of possible outcomes given input assumptions. This will occupy our thoughts throughout the book. Finally, in Chapter 12, we offer a short summary of the book and draw our conclusions.

This brief summary may also suggest the philosophy which underlies this book. We believe that the writers during the 1930s–1960s period (a diverse group running from Ben Graham to J.M. Keynes) were trying to confront real problems and had good ideas. They lacked modern analytical tools, large databases, and the cheap and vast computational power currently available. As the latter became available, the investments literature took a strange turn. Instead of solving these problems, they were increasingly viewed as having been eliminated by assumptions such as efficiency, equilibrium, and no arbitrage conditions. This has not caused the problems to go away, it has simply allowed them to be ignored. Although we make no pretense of having solved all the problems in this book, our goal is at least to address them using modern tools.

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James R. Thompson
Edward E. Williams
M. Chapman Findlay, III

Houston and Los Angeles
September 23, 2002

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Chapter 1

Introduction and the Institutional Environment

1.1 Introduction

Every individual who has more money than required for current consumption is potentially an investor. Whether a person places his or her surplus funds in the bank at a guaranteed rate of interest or speculates by purchasing raw land near a growing metropolis, he or she has made an investment decision. The intelligent investor will seek a rational, consistent approach to personal money management. The best method for some is simply to turn their funds over to someone else for management. A significant number of investors do indeed follow this policy, and it is quite likely the correct decision for many. Others, however, manage their own money or even become professionals who manage other people's funds. The latter groups are the audience for whom this book was written.

In the discussion that follows, we shall not unveil any mysteries about getting rich quickly. Indeed, if such secrets existed, it is doubtful that the authors would be willing to reveal them. Nevertheless, there are systematic procedures for making investment decisions that can enable the rational investor to maximize his or her economic position given whatever constraints he or she wishes to impose. Economic position is tacitly assumed to be the primary goal of the investor, although there may well be those who have other central goals. The purchaser of an art collection, for example, may be more interested in the aesthetic aspects of his investment than the financial appreciation that might be realized. There is nothing irrational about this, and it is not difficult to construct optimal decision models for such an individual. Similarly, another person may be strongly concerned about pollution, or human rights. Such a person may refuse to buy shares in companies that pollute or that do business in countries where ethnic

cleansing is practiced. Again, this can be perfectly reasonable behavior, but these investors should at least be aware of the opportunity costs of their decisions. That is, they should realize that such an investment policy may have economic costs. The polluter may be a very profitable company whose stock could produce exceptional returns for its holders.

Maximizing economic position cannot usually be taken as the only objective of the investor. There is some correlation between the returns one expects from an investment and the amount of risk that must be borne. Thus, decisions must be made that reflect the ability and desire of the individual to assume risk. In this volume, we shall be very specific in both theoretical and practical terms about risk bearing and the optimal portfolio for the investor.

Although intelligence is about the only important personal attribute requisite for any kind of decision making, there are other traits that may be helpful to the investor. In particular, a certain amount of scientific curiosity may be very important to successful investors. By scientific curiosity we do not mean knowledge or even interest in disciplines generally considered "science," such as biology or chemistry, although the scientifically trained analyst may have an advantage in scrutinizing the stocks of high-technology companies. Rather, scientific curiosity refers to the systematic pursuit of understanding. An investor should be willing to take the time and spend the energy to know himself or herself and the investing environment.

It is unfortunately true that many otherwise successful people make poor investors simply because they do not have a logical investment policy. They have only vague objectives about what they want (such as "capital appreciation" or "safety of principal"), and they often substitute general impressions for solid fact gathering. How many highly competent doctors, for example, go beyond the recommendations of their brokers (friends, parents, relatives, or drug company sales people) when selecting a security? How many businesspersons take the time to familiarize themselves with the income statements and balance sheets of the firms in which they hold stock? How many professional portfolio managers make purchases based on a well-researched, documented effort to uncover those securities that others have passed over? Even in the case of portfolio managers, the number may be surprising. Of course, it could be reasoned that the doctor may not have the time or knowledge to make a thorough investigation of his or her investments and that the businessperson is too occupied with his or her own company to do a systematic search for information. If this is the case, then both doctor and businessperson should seek expert counsel.

Although knowledge of what other managers are doing is important and an experienced person's market "feel" may be superior to any professor's theoretical model, too often even the professional tends to substitute rumor and hunch for sound analysis and thorough investigation. This point will become more obvious in the pages to follow.

In addition to intelligence and scientific curiosity, the modern investor needs to be reasonably versed in mathematics and statistics. In this book, we provide an Appendix for review by those who are somewhat hazy on these subjects.

There are any number of investment possibilities that the investor may consider. The simplest is the commercial bank savings account, or certificate of deposit insured by the United States government. Next, in terms of simplicity, are the U.S. Treasury bills issued by the federal government in maturities of one year or less. These media provide safety of principal, liquidity, and yields that are not unattractive by historical standards. Nevertheless, they require little analysis as an investment vehicle, and any discussion of them must perforce be brief. There is a place for such investments in the portfolio of most investors, however, and the role of liquidity in investment strategy will be a focal point in the portfolio chapters coming later in this book.

At the other end of the investments spectrum are such highly illiquid assets as real estate, oil well interests, paintings, coins, stamps, antiques, and even ownership of business enterprises. These investments require a very specialized analysis, and anyone who is contemplating the purchase of such assets should be even more careful than the investor in securities. The unique nature of the aforementioned investment possibilities precludes them from extensive discussion in this book, although many of the techniques that are described in the pages that follow could be equally well applied to these investments.

In between the savings account, certificate of deposit, or U.S. Treasury bill and the illiquid assets mentioned above, are a host of investments that can generally be described as securities. A *security* is an instrument signifying either ownership or indebtedness that is negotiable and that may or may not be marketable. Securities are by far the most popular form of semiliquid investment (i.e., investment that is marketable but that may not be salable near the price at which the asset was purchased), and they can be analyzed in a systematic, consistent fashion. For this reason, the focus of this book will be on securities. We shall mostly be concerned with *common stocks* which are securities signifying ownership in a corporation or similar entity.

It was mentioned before that the investor should be well aware of the investment environment before he or she makes a decision. The environment for securities includes such important variables as the general state of the economy, the expected risk and return levels from purchasing a specific security, and the economic position of the investor. It also includes the more specific aspects of securities regulations, financial information flows, the securities markets, and general measures of security price performance (such as the Dow Jones averages). There are entire books devoted to each of these topics, and we will not purport to examine any of them in much detail. Nevertheless, the more important elements of these subjects will be

discussed later in this chapter.

1.2 The Stock Market Efficiency Question

Of all the forms of securities, common stocks (and derivatives of common stocks) are the most romantic. Although the bond markets are quite important to both issuing corporations and many investors (pension fund money, life insurance reserves, bank portfolio funds, and so on in the aggregate are more heavily invested in bonds than equities), it is the stock market that engenders the interest of most investors. This is undoubtedly true because the rewards (and penalties) of stock market investment well exceed those obtainable in the bond market. Furthermore, equity analysis is more complicated than bond appraisal, and greater skill is required in selecting common stocks than fixed income securities. This is not to say that bond analysis is simple or even uninteresting. Indeed, some of the more sophisticated minds in the investments business are engaged in the bond market. Nevertheless, few people spend their lunch hours talking about the bond market, and the future performance of a bond rarely comes up in bridge table or golf course discussions. It is common stocks that entice most investors, and some investors have been known to feel a greater empathy for their stocks than their wives (or husbands). Thus, common stocks (and derivatives of common stocks) will be our focal point.

There is a school of thought that maintains that only insiders and those privileged to have information not known to the rest of us can make large profits in the stock market. These people subscribe to a theory of stock prices called the *efficient market hypothesis* (EMH). EMH advocates argue that the current price of a stock contains all available information possessed by investors and only new information can change equity returns. Because new information becomes available randomly, there should be no reason to expect any systematic movements in stock returns. Advocates of the EMH feel that the stock market is perfectly efficient and the cost of research and investigation would not be justified by any “bargains” (i.e., undervalued stocks) found.

The efficient market hypothesis has been tested by a number of scholars. These researchers have considered various hypotheses about the behavior of the stock market, from notions that past stock prices can be used to forecast future prices (the belief held by stock market chartists or “technicians”) to reasoned opinions that stocks exist that are undervalued by the market and that these stocks can be uncovered by a thorough investigation of such fundamental variables as reported earnings, sales, price to earnings (P/E) multiples, and other pieces of economic or accounting data. The latter view of the market has long been held by most investors, and the whole profession of security analysis depends upon it. From the early days of the first edition of Graham and Dodd [10] down to the present, analysts have

been taught that there are overpriced stocks and underpriced stocks and it is the job of the analyst to determine which are which. The EMH advocates have found, however, that the presence of so many individuals trying to find bargains (and overpriced stocks to sell short) makes it impossible for any one of them to outperform the general market consistently. Thus, as the economy grows and earnings increase, it is possible to make money in the stock market, but it is impossible to expect more than “average” returns. This is true, they say, because there are many buyers and many sellers in the market who have a great deal of similar information about stocks. If any one stock were “worth” more than the price for which it was currently selling, sharp analysts would recommend buying until its price rose to the point at which it was no longer a bargain. Similarly, if a stock were selling for more than its intrinsic value, analysts would recommend selling. The price of the security would fall until it was no longer overpriced.

The efficient market hypothesis has gained great currency in many quarters, particularly among academic economists, beginning in the early 1970s (see [5]). Nevertheless, it has not convinced too many practitioners, and many financial economists today no longer accept the EMH unequivocally (see [6] and especially [11]). This may be for two reasons. In the first place, if the EMH were believed, it would be hard for professionals to justify the salaries that they are paid to find better-than-average performers. Second, many analysts have suggested that their very presence is required for the EMH to work. If they could not find undervalued stocks, they would not come to their desks each day; and if they did not appear, there would no longer be that vast army of competitors to make the stock market efficient and competitive! Moreover, many analysts point out that there are substantial differences of opinion over the same information. Thus, although every investor may have available similar information, some see favorable signs where others see unfavorable ones. Furthermore, various analysts can do different things with the same data. Some may be able to forecast future earnings, for example, far more accurately than others simply because they employ a better analytical and more systematic approach. It is these differences of opinion and analytical abilities that make a horse race, and most practitioners (and an increasing number of financial economists) believe that this is what the market is all about.

1.3 Some History

Long before the EMH began to gain advocates, many economists (and almost all practitioners) believed that the stock market was neither competitive nor efficient (see [20]). These individuals viewed the market historically as an expression of the whim and fancy of the select few, a large gambling casino for the rich, so to speak. It has been observed that securities speculation in the past has been far from scientific and that emotion rather than

reason has often guided the path of stock prices. Inefficiency proponents believed that people are governed principally by their emotions and that bull and bear markets are merely reflections of the optimism or pessimism of the day. They argued that economics plays a slight role in the market and that investor psychology is more important. This view traces back over 130 years. Charles Mackay, in a famous book published in 1869, entitled *Memoirs of Extraordinary Popular Delusions and the Madness of Crowds* ([16], pp. vii–viii) argued:

In reading the history of nations, we find that, like individuals, they have their whims and their peculiarities-, their seasons of excitement and recklessness, when they care not what they do. We find that whole communities suddenly fix their minds upon one object, and go mad in its pursuit; that millions of people become simultaneously impressed with one delusion, and run after it, till their attention is caught by some new folly more captivating than the first. We see one nation suddenly seized, from its highest to its lowest members, with a fierce desire of military glory; another as suddenly becoming crazed upon a religious scruple; and neither of them recovering its senses until it has shed rivers of blood and sowed a harvest of groans and tears, to be reaped by its posterity Money, again, has often been a cause of the delusion of multitudes. Sober nations have all at once become desperate gamblers, and risked almost their existence upon the turn of a piece of paper.

Mackay's fascinating story details some of the most unbelievable financial events in history: (1) John Law's Mississippi scheme, which sold shares, to the French public, in a company that was to have a monopoly of trade in the province of Louisiana. Mississippi shares were eagerly bought up by French investors who knew that this "growth stock" could not help but make them rich. After all, it was common knowledge that Louisiana abounded in precious metals. (2) The South-Sea Bubble, which induced Englishmen to speculate on a trading monopoly in an area (the South Atlantic) owned by a foreign power (Spain) that had no intention of allowing the English into the area for free trading purposes. The fevers produced by the South-Sea spilled over into other "bubbles," one of which proposed to build cannons capable of discharging square and round cannon balls ("guaranteed to revolutionize the art of war") and another that sought share subscribers to "a company for carrying on an undertaking of great advantage, but nobody to know what it is" ([16], p. 53). (3) The Tulipomania, which engulfed seventeenth-century Holland. Fortunes were made (and later lost) on the belief that every rich man would wish to possess a fine tulip garden (and many did, for a while at least). Tulip bulb prices reached astronomical levels, as one speculator bought bulbs to sell at higher prices to a second speculator who purchased to sell at even higher prices to yet another speculator.