EFFICIENT MARKETS, COSTLY INFORMATION, AND SECURITIES RESEARCH

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Courts, administrative policy makers and legal scholars have widely embraced the theory that well-developed markets are efficient. In this Article, Professors Gordon and Kornhauser cast doubt on the wisdom of reliance on the efficient market hypothesis as applied to various areas of corporate law. Their charge is that legal decision makers and scholars have misunderstood the assumptions and limitations of the theory and have neglected recent critical economics scholarship. Professors Gordon and Kornhauser begin by detailing the assertions of the hypothesis in relation to the workings of securities markets, focusing on various asset pricing models used to test the hypothesis. They then examine critically the interrelation between the hypothesis and the processes by which information is acquired and reflected in market price. Finally, they explore the legal policy implications of the problems they have exposed: markets are not as "efficient" as once thought, and we may not be able accurately to test the efficiency of a given market.

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INTRODUCTION

Judges, regulators and legal scholars rarely follow the fads and fashions of theoretical innovation in mathematical economics. Yet the efficient market hypothesis (EMH), formulated in the mid-1960's, has strongly influenced not only legal theory but also prevailing doctrines and regulations. For example, the Securities and Exchange Commission (SEC) has amended its disclosure requirements to permit issuers with large market capitalization to use abbreviated disclosure statements and the pinpoint timing device of "shelf registration" in the sale of securities. The Commission premised its action on the belief that "investors are protected by the market's analysis of information about certain companies which is widely available, both from the Commission's files and other sources, and that such analysis is reflected in the price of the securi-


2 The reference is to the SEC's "integrated disclosure" system and "shelf registration" rule, discussed at text accompanying notes 119-70.
The courts have on occasion also relied on the efficient market hypothesis. Some recent judicial decisions have held that the plaintiff in a private securities fraud action need not have read the prospectus in which the misstatement or omission occurred. For the plaintiff to sustain a cause of action, these decisions require only proof that defendant's misleading statements or omissions affected the market price of the relevant security. This startling conception of fraud rests on acceptance of the efficient market hypothesis that the price of a security reflects all information available in the market. Consequently, the particular plaintiff need not have read the prospectus to have "relied" on and been injured by the misstatement or omission.

The efficient market hypothesis also lies at the center of the debate over the theoretical bases of much of corporate law. Some scholars have argued that the markets for corporate control and executive services minimize, to the extent possible, conflicts between shareholders and managers in large publicly held corporations and consequently obviate the need for extensive legal intervention. Under this view, most legal rules regul-

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Much of this writing by legal academics looks to recent economic analysis of the business firm. E.g., Fama, Agency Problems and the Theory of the Firm, 88 J. Pol. Econ. 288 (1980); Jensen & Meckling, Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, 3 J. Fin. Econ. 305 (1976). Another important source is Manne, Mergers and the Market for Corporate Control, 73 J. Pol. Econ. 110 (1965). For skepticism on the scope of market discipline, see Coffee, Regulating the Market for Corporate Control: A Critical Assessment of the Tender Offer's Role in Corporate Governance, 84 Colum. L. Rev. 1145, 1199-
lating management behavior in the ordinary course of business would be eliminated, while those rules that bar managements from interfering with the operation of the market for corporate control would be nearly absolute. Apart from any other objections, this view is tenable only if stock prices, including price changes, accurately reflect management performance and comparative company prospects. This means, in EMH terms, that sufficient information about management performance and company prospects must be available to the market and that prevailing prices accurately reflect such information.

Modern theories of "prudent" behavior by institutional investors and other financial fiduciaries also rely heavily on the efficient market hypothesis. If markets are "efficient," the expenditure of resources on securities research wastes beneficiary funds. More importantly, efficiency, on this view, implies that an investment strategy attempting to outguess the market must be suspect.

We think that the legal rush to embrace and apply the efficient market hypothesis has been overly precipitous and occasionally unwise. The legal embrace of the EMH has been based principally on economists' empirical tests of the hypothesis in the 1960's and early 1970's. Economic research and controversy about the hypothesis had a second flourishing that began in the late 1970's and continues today. The more recent economic research and controversy about the hypothesis casts


A more recent article discussing the means by which markets may attain at least relative efficiency is Gilson & Kraakman, The Mechanisms of Market Efficiency, 70 Va. L. Rev. 549 (1984), discussed at notes 83, 192 infra.


7 See notes 84-91 and accompanying text infra.
doubt on EMH's empirical claims and theoretical underpinnings. Whether markets are efficient in the sense claimed by the initial tests is now highly suspect; indeed, even the ability to test for market efficiency is subject to question. Virtually none of this doubt, however, has been reflected in the debates about the implications of the efficient market hypothesis for legal decisionmaking.

The deficiency in the legal debate extends well beyond a failure to keep abreast of the economics literature. Lawyers have not seriously considered the theoretical structure underlying the efficient market hypothesis. Specifically, the claim that the current price of a security traded on an efficient market correctly values all available information about the security must be understood within the context of a specific model of the behavior of financial markets. EMH has influenced legal policy making because it appears to offer an empirically verified account of how markets "really" work. As we shall discuss below, however, any test of market efficiency requires two additional assumptions. First, the tests hypothesize an underlying theory about how the market prices assets. The particular theory used most often in EMH tests, the Capital Asset Pricing Model (CAPM) and its variants, has drawn increasing economic skepticism. It may be only a slight overstatement to say that only in the legal literature is CAPM considered an accurate account of market processes. Second, tests must posit a process of information acquisition by investors. In most instances, tests, and theory, assume some fixed amount of information distributed in some way among investors. But in actual securities markets, the amount of information possessed by the market depends upon investor decisions to acquire information.

This Article seeks to clarify the theoretical and empirical underpinnings of the efficient market hypothesis. To formulate sensible legal policy, one must understand as precisely as possible the assumptions on which the models rest and how closely these assumptions correspond to markets affected by the proposed policy.

In Part I, we clarify what the efficient market hypothesis asserts. This exposition requires three steps. First, we outline the functions that capital markets ideally serve, so that we may better understand what benefits we are able to achieve with legal policy. Second, we provide a

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9 See text accompanying notes 30-63 infra.
simple statement of the efficient market hypothesis and explain its relation to ideal capital markets. Third, we analyze the interrelation of the efficient market hypothesis and asset pricing models. This background underlies the discussion, in Part II, of market efficiency and information acquisition. Part III applies this prior economic discussion to the specific legal context of securities research by institutional investors. This context is significant because of the importance of the activities of institutional investors for market efficiency and the tremendous sums entrusted to their fiduciary management. Moreover, the analysis puts into question not only EMH and thus EMH-based policy prescriptions, but other received legal wisdom as well, particularly the view of appropriate investment strategy by institutional investors. Finally, and more cursorily, we consider SEC disclosure policy and trends in corporate legal theory.

Much of this Article rests on a highly technical economic literature, both theoretical and empirical. We have tried to state in simple terms our understanding of this literature. Additionally, two appendices are provided that outline in greater detail the empirical and theoretical aspects of the economic literature.

No doubt our understanding of the economic theories is not as deep and thorough as we would wish nor our exposition as lucid and accurate as we would hope. But we feel strongly that legal policy and its underlying corporate legal theory must rest not on what we would wish the world to be or on the overinterpretation and haphazard use of dimly understood economic models, but on the sensitive application of our best understanding of these models and the phenomena they seek to describe. To accomplish these tasks, legal policy makers and theorists alike must grapple with the technical economic literature that underlies current conceptions of financial markets.

I

UNDERSTANDING SECURITIES MARKETS

Particular conceptions of the function and operation of securities markets underlie every regulatory scheme for those markets. Formulation of intelligent policy requires an understanding of these conceptions. In this Part, we outline some fundamental elements of the view of securities markets embedded in the efficient market hypothesis.

Before we begin, however, we offer two parallel distinctions: between "real" and "financial" assets and between "allocative" and "speculative" efficiency, on which much of our discussion of the efficient market hypothesis turns. A real capital asset is the actual physical good, while a financial asset represents a claim on the income generated from the physical good (or perhaps some other ownership right). Thus, an equity
share in Company $A$ represents a bundle of claims on the revenues generated by the physical goods (and employees) that constitute the real assets called Company $A$.

The distinction between allocative and speculative efficiency depends on a distinction between (real) investment (i.e., the creation of physical goods) and (financial) savings (i.e., the deferral of consumption from one period to the next). In an allocatively efficient market, investment decisions are made optimally; in a speculatively efficient market, savings decisions are made optimally. The subsequent discussion will clarify and elaborate the role of these two distinctions.

A. Ideal Capital Markets in Simple Worlds

Capital markets serve two functions. First, individuals may want to shift consumption from one period to another. If $A$'s income or anticipated expenses vary, she may wish to save during periods of plenty and to "dissave" (spend her savings) or borrow in periods of income shortfall. Capital markets facilitate individual planning of consumption over time in light of anticipated resources. Second, capital markets provide and allocate investment funds. Investment funds are used to produce "new capital," production facilities that will provide goods and services to be consumed in future periods. These two functions are linked because the consumption that individuals defer today releases resources to be invested in new capital that will produce the goods to be consumed tomorrow. To make a "good" savings decision, an individual must know how much consumption she will get tomorrow for the consumption she gives up today. That is, she must know the financial returns of any security she purchases—namely, the payout of dividends or interest and capital gain or loss. To make a "good" investment decision, the investor must know how much value the new capital will produce in the future. That is, she must know the real returns of the (real) investment—namely, gross revenues less costs of production. We shall call a capital market that induces "good" savings decisions "speculatively efficient" and one that induces "good" (real) investment decisions, "allocatively efficient." A speculatively efficient market need not be allocatively efficient.\(^1\)

Capital markets guide investment and saving decisions through prices. In raising money for new capital expenditures, investors consider the price they can charge in the sale of financial assets. In deciding how

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\(^1\) This claim rests on a Keynesian view of macroeconomics. Keynes noted that financial institutions mediated between the decisions of savers and those of investors. Because the people who decide how much consumption to defer differ from those who decide how much real capital to create, these two decisions may not mesh exactly. An elaboration of how this failure to mesh may lead to inefficiency in one market and efficiency in another lies well beyond the scope of this Article.
much consumption to defer, savers consider the security’s financial returns given the security’s price. Any claim that capital markets work well, therefore, reduces to a claim about the “accuracy” of the prices prevailing on the capital market. The efficient market hypothesis makes a strong claim about the accuracy of prices on well-developed capital markets such as the New York Stock Exchange or the market for government bonds. To evaluate this claim we must understand what it means for prices to be “accurate.”

To begin, let us identify accurate prices for a capital market in a world much simpler than the one in which the New York Stock Exchange operates. The hallmark of this simpler world is certainty. Let us assume that securities are identified by the date of maturity and the (invariable) (financial) returns on that date. Certainty suggests that each trader knows the returns from owning any security. Prices should accurately reflect the relative returns of securities. Thus, if two securities, \( X \) and \( Y \), mature on the same date and offer the same returns, their prices should be identical. Similarly, if \( X \) and \( Y \) have the same maturity date but \( X \) offers higher returns than \( Y \), the price of \( X \) should be higher than the price of \( Y \). In fact, prices in this perfect market would equalize the financial returns available from purchasing different securities.\(^1\)

Notice why accurate capital market prices are desirable in this certain world. Suppose some security was “undervalued.” That would mean that its price was lower than warranted by its returns. On the maturity date a purchaser of the security would be pleasantly surprised; she would receive more than the price entitled her to expect. At the date of purchase, however, those who judged returns only by market prices would thus have been less willing to purchase the undervalued security than was warranted by the promised returns. In fact, a purchaser who judged her savings opportunities only by market prices would have underestimated the amount of future consumption available to her from saving. Consequently she would save too little.\(^2\) The analysis reverses itself in the case of “overvalued” securities; the individual would save

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1. This discussion assumes that asset prices are determined by financial payouts. It thus illustrates the point discussed in greater detail below that analysis of the efficiency of prices also requires a theory of asset pricing.

2. That the potential purchaser would save too little can be seen most easily if the market consists of only one security. Then, for the security to be undervalued means that the purchaser’s beliefs about the returns on the security are too pessimistic. But she bases her decision on how much consumption to defer based on these beliefs about returns. As her beliefs become more favorable, she will defer more and more consumption. Thus, when the security is undervalued—that is, priced too low given the true returns, she saves less than she would if the market provided an accurate value.

If the market consists of many securities, the statement in the text still holds if all other securities are either properly valued or undervalued. In this case, the returns on the market portfolio will be less than they would under accurate prices, and the above argument applies.
more than was warranted by the actual returns received. If prices were
accurate, however, the market would be speculatively efficient and savers
would make appropriate decisions about the proportion of their current
incomes they wished to save.13

Allocative efficiency in this certain world depends upon the connec-
tion between financial returns and real returns.14 For example, assume
that two firms each desire to issue securities to finance a new plant. The
plant that will generate more profits per invested dollar is the more desir-
able real investment and should attract funds first. In a perfectly certain
world, the most productive real investments would receive funds first be-
cause financial returns would always correspond to real returns. There-
fore, the capital market would be both speculatively and allocatively
efficient. Outside of this certain world, however, financial returns of se-
curities may not be accurate measures of the real returns of the issuer's
investment in new capital. Thus, a capital market might accurately re-
fect financial returns but not accurately reflect real returns. It would
then be speculatively efficient, but not allocatively efficient.15

Let us now turn to the decidedly uncertain world of the New York
Stock Exchange. Traders on the Exchange do not know with certainty
the financial returns of securities. They must predict future prices, divi-
dends, and interest to estimate the returns they will receive. On the basis
of these estimated returns they will decide how much to save. If all trad-
ers held the same beliefs about returns, future prices could be extended
with little difficulty from a certain world to an uncertain one. Accurate
prices would reflect the shared belief of each person about the financial

13 Note that the explanation of the desirability of a perfect capital market appears inconsis-
tent. This apparent inconsistency arises because we have partially conflated two ideas in our
single assumption of certainty. The first idea requires that the returns be certain; the second
that investors know what those certain returns will be. Thus, the explanation apparently as-
sumes both that people know the returns of securities and that they know only the prices. In
fact, knowledge of the certain returns need not be universal among investors. Even the exist-
ence of a substantial minority of informed investors, however, makes it difficult to explain how
a security could not be properly valued in a certain world. If security X is undervalued, trad-
ers who know the returns will bid up its price because its return per dollar invested is higher
than that attainable from other securities.

14 Recall that real returns are the profits that the real asset (each plant) will generate (i.e.,
gross revenue less costs). Financial returns are the monetary returns the security generates
(i.e., dividends, interest, and capital gains or losses).

15 Under uncertainty the concepts of speculative and allocative efficiency grow more com-
plicated. Financial yields are associated with probability distributions of future returns and future
prices while real yields are associated with probability distributions of future costs and income
streams. Because individuals may care about the average return of a security or real invest-
ment and also about the dispersion of possible returns, ranking alternative investments is not
as straightforward as it may seem. This difficulty increases if different individuals have differ-
ent attitudes towards risk, which may cause them to rank two securities or investments in
different orders. See the discussion at text accompanying notes 172-73 infra.
returns of securities. If some price did not reflect this shared belief, the security would be under- or overvalued and traders would either bid up its price (because they thought it offered higher returns) or bid down its price (because they thought it offered lower returns). This process would result in speculatively efficient markets. A similar logic underlies the desirability of allocatively efficient markets when investors share beliefs about prospective (real) returns.

The complexity of the analysis increases if we allow participants to have divergent beliefs about real or financial returns. If investors' beliefs about returns differ, different individuals would rank potential investment opportunities in different orders. Consequently, traders estimate future prices differently, and accurate prices become difficult to identify. Ideally, we want the capital market to perform as it did under certainty where stocks are "properly" valued. Security prices therefore should reflect, in some sense, our "best estimate" of the returns of each security. This best estimate would result in allocatively, as well as speculatively, efficient capital markets if the financial returns of securities were also accurate measures of the real returns of the issuer.

B. The Efficient Market Hypothesis

The efficient market hypothesis defines the best estimate of the financial returns of each security. Thus, a good estimate should take into account all available information about future prices. Prices are "efficient" in two senses: (1) the current price of a security best predicts its future price and (2) the prevailing price immediately assimilates new information provided to the market. As a consequence, no trader can earn (financial) arbitrage profits in an efficient market because no one can identify (except by chance) securities which are under- or overvalued.

The efficient market hypothesis thus posits that the mechanism that sets prices in securities markets possesses a startling property. The mechanism of price formation somehow captures information about and predicts the future payout of a security (dividends, interest, and capital gain or loss) as well as about the investor who happens to know, with concrete particularity, all of this relevant information. Thus the efficient market hypothesis embraces two different kinds of claims: that all rele-

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16 This in fact is not so simple. As discussed at note 49 infra, one concept of efficiency also requires "rational expectations"—the idea that investors' beliefs about the distribution of securities prices should be the true distribution of securities prices.

17 For an argument as to why heterogeneity of opinion not only exists in but is essential to the operation of capital markets, see Mayshar, On Divergence of Opinion and Imperfections in Capital Markets, 73 Am. Econ. Rev. 114 (1983).

18 The theory requires that prices assimilate information faster than investors can adjust on the basis of the information. If person A learned the information at time t, he would not be able to act on it before the price reflected the acquired information.
vant information will be available to the market and that the market rapidly, if not instantaneously, digests all information as it becomes available.\textsuperscript{19} As we shall explain below, the efficient market hypothesis makes a claim only for the speculative efficiency of the market.\textsuperscript{20}

It is not difficult to specify conditions under which capital markets will inevitably be speculatively efficient: no transaction costs in trading securities, costless access by all market participants to all available information, and agreement by market participants as to implications of such information for the current price and distributions of future price of each security (i.e., homogenous expectations).\textsuperscript{21} Prices that prevail under these conditions by definition "fully reflect" all available information. The efficient market hypothesis, however, purports to make a strong statement where some of these conditions are not present. It states that despite transaction costs, the lack of universal access to available information, and differing assessments of information, prevailing prices fully reflect available information.

What justifies extending the efficient market hypothesis to circumstances in which its truth is not logically compelled? We might test the hypothesis empirically to discover whether markets are efficient, but unfortunately the efficient market hypothesis cannot be tested in a straightforward way. It is not a hypothesis subject to relatively simple observation, such as "all the balls in the urn are white." The basic data,

\textsuperscript{19} Because much turns on how we interpret the phrase "all relevant information," some precision in the statement of the hypothesis is useful. A market is efficient with respect to information set \( X \) if at a given time \( t \) the information that the market uses to determine security prices at \( t \) includes all the information available in \( X \). E. Fama, Foundations of Finance 136 (1976); see also Jensen, Some Anomalous Evidence Regarding Market Efficiency, 6 J. Fin. Econ. 95, 96 (1978) ("A market is efficient with respect to information set \( \theta \), if it is impossible to make economic profits by trading on the basis of information set \( \theta \).")

\textsuperscript{20} See text accompanying notes 178-83 infra.

\textsuperscript{21} See Fama, supra note 1, at 387.
prices and price changes, are interpretable only through the lens of a larger model of investor behavior and market processes. Thus we cannot test the validity of the efficient market hypothesis alone; every test of EMH also assumes some particular theory of what the “right” price for an asset is. These asset pricing models establish the benchmark of “normal” returns in order to determine the efficiency of the market. Consequently, every empirical test of the efficient market hypothesis is a “joint test” of both the hypothesis and an asset pricing model. If the test yields evidence consistent with market efficiency, it also yields evidence consistent with the asset pricing model. If, however, the test yields anomalous evidence, either the market is inefficient or the asset pricing model used is incorrect (or possibly both EMH and the pricing model are wrong). Understanding EMH therefore requires that we consider the asset pricing models that have been used to test it.

C. Asset Pricing Models

A variety of asset pricing models has been used in tests of the efficient market hypothesis. In Appendix B we consider the asset pricing model underlying the “random walk” hypothesis. Here we concentrate on two other asset pricing models. The first, a positive expected returns model, was used to test the weak form of the efficient market hypothesis. This model illustrates the implications of joint tests of the EMH and asset pricing models. The second, the Capital Assets Pricing Model (CAPM), allowed more sophisticated tests of stronger forms of the efficient market hypothesis.

1. Positive Expected Returns Model

One claim made by technical analysts was that they could identify trigger points for purchases and sales (and short sales) by observing patterns of price movements of a stock. This claim, labeled a filter strategy, is obviously inconsistent with the efficient market hypothesis; it supposes that the history of stock price movements is not fully reflected in the prevailing prices.

Filter strategies have been scrutinized by efficient market tests based on a positive expected returns asset pricing model. All asset pricing models used in tests of the efficient market hypothesis are “expected returns” models: the price of a security (or any risky asset) at time \( t \) directly relates to the return expected as of the end of the relevant holding period, \( t+1 \) (where return is dividends, interest, and capital gain or

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22 See Appendix B infra.
23 See text accompanying note 27 infra.
24 See text accompanying note 28 infra.
The positive expected returns model makes the very limited claim that this expected return is positive. This is a claim with strong intuitive appeal. Why would anyone acquire a risky asset without the expectation that its value would increase? The implication of this model, however, is that filter strategies cannot outperform a buy-and-hold strategy.

A filter strategy has the following form: Suppose an investor at time 0 notices that the price of a stock is \( P_0 \). She should purchase the stock when it moves up \( x \) percent (to \( [1 + x]P_0 \)). She should hold the stock until it passes its first "peak" price \( P_1 \) and declines from that peak by \( x \) percent (to \( [1 - x]P_1 \)). At this point (\( P = [1 - x]P_1 \)), the investor sells the

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25 Formally, expected returns models assume that:

\[
E(P_{t+1}/h_t) = [1 + E(r_{t+1}/h_t)] P_t
\]

where \( E \) is a procedure for determining expected value of a distribution;

\( P_t \) is the price of security \( j \) at time \( t \);

\( P_{t+1} \) is its price at \( t+1 \) (including reinvestment of dividends or interest in respect of the security);

\( r_{t+1} \) is the one period percentage return for security \( j \) [i.e., \( (P_{t+1} - P_t) / P_t \)];

\( h_t \) is a general symbol for whatever set of information is assumed to be "fully reflected" in the price at \( t \);

and the tildes (~) indicate that \( P_{t+1} \) and \( r_{t+1} \) are random variables at \( t \).

In words, this expression states that, at time \( t \), the expected price of a security at time \( t+1 \) will be the sum of the price at time \( t \) and the expected returns from time \( t \) to \( t+1 \). The expression, thus, effectively calculates how much money an investor would have at the end of period \( t+1 \) if she invested \( P_t \) at period \( t \) with a return of \( r_{t+1} \). The expression assumes a relation between prices and returns resulting from a price formation process in which, on the basis of all the information available at time \( t \), investors predict the expected value of the distribution of possible prices. This prediction of the expected price requires that investors predict, given their information \( h_t \), the range (or "distribution") of prices for security \( j \) at time \( t+1 \) (\( P_{t+1} \)) and the probability that any price within the range will be the observed price at \( t+1 \). The expected price is simply the weighted average of possible prices. This expected value determination of \( P_{t+1} \) is based on a similar expected value determination of the distribution of returns during the \( t \) to \( t+1 \) period of security \( j \) [\( E(r_{t+1}/h_t) \)], again using all the information available at time \( t \) for the determination. The equilibrium price for security \( j \) at time \( t \) (\( P_{t+1} \)) balances the guesses and desires of different investors. At the equilibrium prices each investor is satisfied with his own portfolio; no one desires to trade any security. The market "clears." In the abstract formulation presented, however, the model does not allow empirical testing. It does not specify the nature of investor expectations or preferences. The challenge of course is to devise expected return models that allow the investor and the experimenter to calculate the expected return \( E(r_{t+1}/h_t) \). See E. Fama, supra note 19, at 134-37.

To understand what is meant by designating prices or returns as random variables, one should imagine that actual prices (or returns) are determined by drawing a ball from an urn on which the price (or return) is recorded. The notation \( P_j \) (or \( r_j \)) refers to this process of drawing a particular ball from the urn. The number recorded on the ball is the realization of \( P_j \) (or \( r_j \)). The distribution of all possible \( P_j \)’s (or \( r_j \)’s) is determined by the composition of balls in the urn. The probability of drawing any particular price \( P_j \) (or return \( r_j \)) is simply the number of balls with that price (or return) recorded on them divided by the number of balls in the urn.

26 In formal expression, \( E(r_{t+1}/h_t) > 0 \). That is not to say that observed returns (or "realizations") at time \( t+1 \) may not be negative, only that the expectations at time \( t \) of returns at \( t+1 \) are positive.
stock and goes short (i.e., sells borrowed stock that she promises to replace). The price will now fall to some "trough" $P_2$. When the price rises by $x$ percent above the trough (to $[1+x]P_2$), the investor covers the short position (i.e., buys enough stock to replace the borrowed stock) and buys additional stock for her own account. The investor’s profit in this first cycle of the filter consists of two parts: her gain on the first purchase and sale ($[1-x]P_1 - [1+x]P_0$) and her gain on the short transaction ($[1-x]P_1 - [1+x]P_2$).\(^{27}\)

Such a strategy conflicts with the assumption that the expected return on a security is positive. At the time of the short sale, this investor expects negative returns. She expects to replace the borrowed stock at a lower price. A buyer who purchased the stock at the time of the short sale would have suffered a capital loss by the time the short seller covered. Hence, the filter strategy will have outperformed the buy-and-hold strategy, in seeming contradiction of the positive expected returns model.

A technical analyst who uses a filter theory, however, need not dispute the proposition that current prices are set with the expectation of positive future returns. He might instead challenge market efficiency by claiming that the market, in projecting future returns and, thus, setting current prices, incorrectly assesses information contained in past prices. The market would, thus, anticipate positive expected returns from a security when, in light of past prices, the "correct" expected return is negative. Demonstrating that filter strategies do not generate trading profits refutes the analyst's market inefficiency claim.\(^{28}\)

Observe how an experiment in which filter strategies outperform the buy-and-hold strategy rejects the joint hypotheses of an efficient market and of the positive expected returns equilibrium model. That filter strategies outperform buy-and-hold does not necessarily discredit the efficient market hypothesis; perhaps the positive expected returns model does not offer the correct benchmark for normal returns. On the other hand, the model makes a very limited claim about equilibrium market prices. To reject the equilibrium model requires the rather unlikely assumption

\(^{27}\) It is not necessary for the percentage price change trigger to be identical for buy and sell signals. The text uses the same percentage for ease of exposition.

A filter strategy admits that one cannot predict which price is the peak or trough. However, it assumes that one can predict turns in the market. (If $P_1$ is very close to $P_0$, the investor suffers a loss due to transaction costs; so she must notice significant turns in the market for the security.)

\(^{28}\) When various filters were tested for profitability against a passive strategy of buy-and-hold, the latter strategy provided superior returns in all cases relevant to market participants. Although some very small filters generated some theoretical gains, the fees and commissions resulting from the numerous transactions triggered by such filters would wipe out any profits, even for floor traders. Fama & Blume, Filter Rules and Stock-Market Trading, 39 J. Bus. 226 (1966).
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that, in general, individuals hold securities expecting to have nonpositive or possibly negative returns. Thus, for filter strategies to outperform buy-and-hold strategies would be significant evidence against the efficient market hypothesis.

2. Capital Asset Pricing Model

The positive expected returns model has only limited use in tests of the efficient market hypothesis. First, it models the investment decision simply as a choice between holding cash or holding a security. It also assumes decisionmaking on a security by security basis whereas investors, particularly institutional investors, more plausibly evaluate their decisions on a portfolio basis. Second, investors seem to select securities on the basis of comparative expected performance. The positive expected returns model provides no way to compare relative prices and price movements. Third, the model allows us to test the efficiency of the market only with respect to a restricted information set—that of past prices (i.e., a filter strategy). Because the model places so little structure on the mechanism of asset pricing, we cannot test the efficiency of the market with respect to more varied information sets.

To “strengthen” the efficient market hypothesis, economists devised market efficiency tests with respect to three other classes of information sets. First, “public announcement tests” examine market reaction to public announcements of company-specific information: stock splits, dividends, earnings and primary and secondary securities offerings. Second, “privately-produced information tests” examine whether institutional investors, using sophisticated analysis of publicly available information, achieve results superior to individual investors. Third, “private information tests” examine whether particular investors, having access to private corporate information not yet reflected in securities

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29 It may be the case that investors also include in their portfolio securities having negative expected returns as a means of increasing the covariance between stocks in order to reduce risk. See text accompanying notes 37-43 infra. But it seems unlikely that such a strategy would predominate.

30 Empirical observations of monthly price changes on the New York Stock Exchange show that, although successive price changes for a security are not correlated, such changes correlate in a relatively stable way with general market movements. E. Fama, supra note 19, at 14. For example, if the market, as measured by a representative index, moves up 10%, some stocks will regularly move up 15%, others 10%, and still others 5%. This observation is particularly important for the efficient market theory, because tests of greater than expected returns should correct for gains (and losses) from general market factors. For example, suppose during a bull market a securities analyst regularly picked stocks that outperformed the market. A test of whether this success was inconsistent with the efficient market hypothesis must account for the stocks' regular relationships to market movements.

31 See Appendix A at text accompanying notes 200-07, 225-41 infra.

32 See Appendix A at text accompanying notes 208-20, 241-45 infra.
prices, are able to outperform other investors.\textsuperscript{33}

To test market efficiency with respect to these broader information sets requires the identification of a "normal" or "appropriate" price for each security, as a constant against which to measure superior performance claims. Through such a comparison one could determine whether investors with access to particular information sets can outperform investors whose knowledge is limited to information reflected through the prevailing securities prices. To accomplish this task, economists have employed more extensive theories of asset pricing. The most prominent of these theories, the Capital Assets Pricing Model (CAPM), addresses both the problem of testing nonprice information sets and the problem of portfolio versus security selection. Thus, CAPM has implications not only for understanding the efficient market hypothesis but also for legal duties governing fiduciaries.

CAPM makes operational a model of investor behavior—portfolio theory—that rests on the assumption that investors seek to maximize their "expected utility" in an uncertain world.\textsuperscript{34} This utility increases as returns rise and decreases as risk grows. Thus, "risk aversion" means that individuals are willing to accept a lower return in order to avoid risk.\textsuperscript{35} A risk-averse investor will evaluate asset performance in a portfolio rather than in isolation. She will select an "efficient portfolio"—a collection of assets such that for a given level of risk, the investor receives the greatest expected return.\textsuperscript{36}

\textsuperscript{33} See Appendix A at text accompanying note 209 infra.

\textsuperscript{34} See generally Jensen, Capital Markets: Theory and Evidence, 3 Bell J. Econ. & Mgmt. Sci. 357 (1972).

\textsuperscript{35} To take a simple example, imagine two assets, Able and Baker, maturing in one year, with the following distribution of projected returns:

<table>
<thead>
<tr>
<th>Return(Able)</th>
<th>Return(Baker)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% chance</td>
<td>100</td>
</tr>
<tr>
<td>50% chance</td>
<td>200</td>
</tr>
<tr>
<td>25% chance</td>
<td>300</td>
</tr>
</tbody>
</table>

Even though the expected return of each asset (the weighted arithmetic average or "mean") is identical (200), Baker is a riskier investment because the dispersion of possible returns is greater. In particular, there is a greater probability of poor outcomes from Baker. Thus the typical risk-averse investor would prefer Able. The price of Able will be bid up relative to Baker, meaning that the expected return on Able (in this case, year-end payout divided by purchase price) will be lower. Both assets are riskier, and hence less desirable to a risk-averse investor, than an asset that guarantees a payment of 200. The typical measures of risk are "variance" or "standard deviation" (the square root of variance). These measures compare the riskiness of securities in terms of unit risk per unit expected return. For elaboration, see R. Brealey & S. Myers, Principles of Corporate Finance 119-22 (2d ed. 1984); J. Weston & E. Brigham, Managerial Finance 95-99 (7th ed. 1981).

\textsuperscript{36} This follows from the investor's desire to maximize utility, rather than expected returns. For example, an investor may have an appetite for higher expected returns, yet also desire peace of mind. Regardless of an investor's particular trade-off (or "indifference curve") between risk and return, she will prefer the highest expected return for the risk borne. Standard
To evaluate the performance of a portfolio the investor must determine both its expected return and its risk. Expected portfolio return equals the weighted sum of the expected returns of portfolio assets.\(^3\) If we measure the risk of the portfolio by the dispersion in its returns, however, the portfolio risk will not equal the weighted sum of dispersion in return of the assets that comprise the portfolio. The returns of individual assets may vary in ways that reduce the dispersion of total return. Consequently, portfolio risk (or dispersion) is primarily a function of the "covariance" (or comovement or association) of the returns of individual assets in the portfolio.\(^3\)\(^8\)

The dependence of portfolio risk on the covariance\(^3\)\(^9\) of individual asset returns implies that investors will hold a diversified portfolio, because the return on a collection of assets whose returns vary in response to different events is more stable than the return on a single asset. More precisely, by selecting securities whose expected returns fluctuate out of sync with one another, one can reduce the dispersion in returns from the portfolio without lowering expected returns. Assets whose returns have "negative covariance" reduce risk the most.\(^4\)\(^0\) But as long as the risk characteristics of two assets are not identical, a portfolio combining them will be "more efficient" than holding either one separately.\(^4\)\(^1\)

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\(^3\)\(^7\)\ For example, the expected return of a portfolio consisting of 25% Able and 75% Baker would be (.25)(200) + (.75)(200) = 200.

\(^3\)\(^8\)\ For elaboration, see, e.g., J. Lorie & M. Hamilton, supra note 36, at 174-83.

\(^3\)\(^9\)\ Covariance is a measure of how stock prices move in relation to one other. If the price movements are highly correlated, then the absolute value of the covariance is high. More technically, the covariance of two random variables \(x\) and \(y\) is given by \(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\), the expected value of the product of the deviations from the mean.

\(^4\)\(^0\)\ A negative covariance between stock price \(A\) and stock price \(B\) means that positive deviations from the mean price of stock \(A\) are more often associated with negative deviations from the mean price of stock \(B\). The more uniform the associated movements are between \(A\) and \(B\), the more highly (negatively) correlated are the stocks. For example, the raincoat manufacturer in note 41 infra, who will have higher-than-expected returns in a mild, rainy winter, may offset the disappointing returns of a snowblower manufacturer for the same time period.

\(^4\)\(^1\)\ Consider the story of three firms: Raincoat Manufacturer, Inc. (\(R\)); Snowblower Manufacturer, Inc. (\(S\)); and Woolen Coat Manufacturer, Inc. (\(W\)). For simplicity's sake, assume there is a 25% chance of an unusually cold and snowy winter, a 25% chance of an unusually mild and rainy winter, and a 50% chance of an average winter, resulting in the following payoff structure:

<table>
<thead>
<tr>
<th>Stock</th>
<th>Snowy</th>
<th>Average</th>
<th>Rainy</th>
<th>Exp. Return</th>
<th>Risk (Variance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>6.0</td>
<td>10.0</td>
<td>14.0</td>
<td>10.0</td>
<td>8.0</td>
</tr>
<tr>
<td>S</td>
<td>18.0</td>
<td>8.0</td>
<td>6.0</td>
<td>10.0</td>
<td>22.0</td>
</tr>
<tr>
<td>W</td>
<td>13.0</td>
<td>12.0</td>
<td>3.0</td>
<td>10.0</td>
<td>16.5</td>
</tr>
</tbody>
</table>

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\(x\) and \(y\): The symbols \(x\) and \(y\) represent variables, and \(\text{Ex}\) and \(\text{Ey}\) represent their expected values.

\(E\): The symbol \(E\) represents the expectation operator, which calculates the expected value of a random variable.

\(\text{cov}(x,y)\): The symbol \(\text{cov}(x,y)\) represents the covariance between the random variables \(x\) and \(y\), which measures how much the variables vary together.

\(\text{Ex}\): The symbol \(\text{Ex}\) represents the expected value of the variable \(x\), which is the long-run average value of the variable.

\(\text{Ey}\): The symbol \(\text{Ey}\) represents the expected value of the variable \(y\), which is the long-run average value of the variable.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula shows how much two variables vary together in a statistical sense.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a mathematical expression that quantifies the degree to which two variables move together in the same direction. A positive covariance indicates that the variables tend to increase or decrease together, while a negative covariance indicates that they tend to move in opposite directions.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a fundamental concept in statistics and is used extensively in finance to assess the risk and return characteristics of investments.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a measure of the linear dependence between two random variables. It provides insight into the nature of their relationship, whether it is positive or negative, and how strong this relationship is.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a key component in portfolio theory, where it helps in understanding the diversification benefits of holding a mix of assets.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is used to calculate the portfolio variance, which is a measure of the risk associated with the portfolio.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a cornerstone in modern portfolio theory, where it is used to determine the optimal mix of assets that maximizes return for a given level of risk or minimizes risk for a given level of return.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a critical tool in financial modeling, allowing for the assessment of risk and return trade-offs in investment decisions.

\(\text{cov}(x,y) = E[(x - \text{Ex})(y - \text{Ey})]\): The covariance formula is a mathematical expression that is central to many areas of applied statistics and economics, including finance, econometrics, and engineering.
The opportunity to diversify has implications for the pricing of individual securities. The risk associated with the return on any particular asset divides into two elements: the risks peculiar to the issuer ("unsystematic" or "company-specific" risk) such as a labor dispute, an unanticipated change in consumer tastes, or a major discovery or invention; and the risks to issuers generally ("systematic" or "nondiversifiable" risk) such as a recession, economic upturn, or inflation rate variations. Appropriate diversification eliminates virtually all of the unsystematic risk in a portfolio. Because investors compete to assemble efficient portfolios, an asset's price reflects only the risk it contributes to a perfectly diversified portfolio. The market compensates investors, through greater expected return (the "risk premium"), only for that element of risk that cannot be eliminated by diversification.

CAPM makes an explicit assumption about the relation of asset return to the market return and to the asset's systematic risk. It states that the expected returns on an asset (or portfolio) is the sum of the return on a risk-free asset ($r_f$) and a risk premium. The risk premium is the difference between the expected return of the market index, "$M,$" and the risk-

Assume that an investor can choose a portfolio of two stocks or less. Because the risk of the portfolio is a function of a security's covariance, the investor can maintain the same expected return while lowering risk, as illustrated by the following payoff structure for these equally-weighted securities portfolios.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Snowy</th>
<th>Average</th>
<th>Rainy</th>
<th>Exp. Return</th>
<th>Risk (variance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R,S</td>
<td>12.0</td>
<td>9.0</td>
<td>10.0</td>
<td>10.0</td>
<td>1.5</td>
</tr>
<tr>
<td>R,W</td>
<td>9.5</td>
<td>11.0</td>
<td>8.5</td>
<td>10.0</td>
<td>1.125</td>
</tr>
<tr>
<td>S,W</td>
<td>15.5</td>
<td>10.0</td>
<td>4.5</td>
<td>10.0</td>
<td>15.125</td>
</tr>
</tbody>
</table>

(Those wondering about the derivation of the variance should examine, e.g., R. Radcliffe, Investment: Concepts, Analysis, and Strategy 140-56 (1982.).)

Note that the R,W portfolio is the most efficient, because manufacturers of raincoats and woolen coats have the highest degree of negative covariance. The R,S portfolio is more efficient than holding any of the stocks alone, but less efficient than R,W. Note further that although combining stocks with negative covariance best reduces risk, portfolios with securities of positive covariance (such as S,W) may still be more efficient than holding the stocks alone.

The construction of actual portfolios is more complicated than this simple illustration. For example, our simplifying assumption of equal weights of securities in the portfolio is arbitrary; one can adjust expected return and risk of portfolio by varying proportions of particular securities.

Studies have shown that high levels of diversification may be obtained with portfolios of relatively few stocks. Indeed, "[o]nce the portfolio has 20 securities, further diversification has little effect." E. Fama, supra note 19, at 253-54. Yet, highly diversified portfolios (as many as 100 stocks) do contain small but significant amounts of nonsystematic risk. W. Sharpe, Investments 116-17 (1978).

Alternatively stated, a security's price is a function of its risk. The relevant risk, however, relates to its returns vis-à-vis the returns on an efficient portfolio, not vis-à-vis itself. In other words, a security's price is based on its performance in an efficient portfolio, not its performance in isolation.
free rate, multiplied by a term, "Beta." Beta reflects the volatility of the asset (or portfolio) in comparison to the market index.\textsuperscript{44} CAPM divides the asset's expected return into two components: the return on a risk-free asset, such as a Treasury bill, and the return in respect to the asset's systematic (nondiversifiable) risk.\textsuperscript{45} CAPM has important implications

\textsuperscript{44} Formally, one writes:

\[ E(r_i) = r_f + \beta_i (E(r_M) - r_f) \]

where \( E \) is a procedure for determining expected value of a distribution;
\( r_i \) is the percentage return on asset i (or portfolio i);
\( r_f \) is the percentage return on a risk free asset;
\( r_M \) is the percentage return on the market index of all risky assets;
\( \beta_i \) is a measure of the volatility of asset i (or portfolio i) relative to the market index;
and the tildes (\( \sim \)) indicate that \( r_i \) and \( r_M \) are random variables.

"Beta" may be more formally expressed as follows:

\[ \beta_i = \frac{\text{cov}(\tilde{r}_i, \tilde{r}_M)}{\sigma_{\tilde{r}_M}^2} \]

where \( \sigma_{\tilde{r}_M} \) is the variance of the returns on the market index.

\[ \beta_i = \frac{\text{corr}(i, M) \sigma_i \sigma_M}{\sigma_i^2 \sigma_M} \]

where \( \text{corr}(i, M) \) is the correlation coefficient between asset i and the market index M, \( \sigma_i \) is the standard deviation of returns on asset i, and \( \sigma_M \) is the standard deviation of returns on the market index.

In unpacking covariance, equation (2) shows that for assets having identical correlation to the market index, the riskier asset will have a higher beta, and that for assets of the same risk, the asset with less correlation will have a lower beta.


\textsuperscript{45} CAPM may also be stated as a series of statements about the pricing of risk: first, that investors will insist on compensation for accepting risk; second, in a competitive market the only kind of risk for which investors will obtain compensation is the volatility of a security's return vis-à-vis return on the market generally; third, the key parameter in establishing the risk premium of a risky security is a measure of that volatility, i.e., a security's beta.

In this way CAPM operationalizes portfolio theory. Directly applied, portfolio theory requires the computation of expected returns, variances, and covariances for all assets, and maximizes the combinations for efficiency (highest expected returns, least risk) for portfolios of varying degrees of risk. Even with current high speed computers, the computation burden could prove insurmountable. (For example, a direct application of portfolio theory for 1,000 securities requires approximately 500,000 computations; with CAPM, the number falls to only 3000. J. Lorie & H. Hamilton, supra note 36, at 199). The appeal of CAPM is the focus on one presumptively efficient portfolio, the market index, and measurement of risk of single assets or
for portfolio management. Here we focus attention on the relation of CAPM to the efficient market hypothesis.

As we discuss in Appendix A, the initial tests in the early 1970's using CAPM tended to confirm the efficient market hypothesis. Testing continued, however, using a more refined methodology. The results of these recent empirical tests have contradicted the earlier evidence re-
portfolios in comparison to the market index. CAPM also has considerable aesthetic and methodological appeal to economists. It derives an estimatable equation from principles that govern individual choice and thus unifies financial theory with the rest of microeconomics.

46 CAPM implies that efficient portfolios consist of a combination of the market portfolio and the risk-free asset, in positive or negative amounts. Because optimal diversification eliminates nonsystematic risk, the best portfolio is the market portfolio, which by definition is subject only to systematic risk. An investor who wishes a portfolio less risky than the market should reduce her holdings of the market portfolio and acquire risk-free assets. Conversely, an investor seeking greater risk should leverage her holdings of the market portfolio by borrowing. This may be illustrated by the following graph:

\[
\begin{align*}
\text{(Expected Return)} & \\
R_F & \\
\text{Capital Market Line} & \\
\text{Efficient Portfolio Frontier} & \\
\ .5 & 1.0 & 1.5 & \text{Risk (\(\beta\))}
\end{align*}
\]

The capital market line represents expected returns at particular levels of risk from combinations of the most efficient portfolio of risky assets (presumably the market portfolio \(M\)) with the risky asset in positive (lending) or negative (borrowing) amounts. The gap between the capital market line and the efficient portfolio (of risky assets) frontier represents the gains from using this so-called "Separation Theorem" in the construction of portfolios. See Tobin, Liquidity Preference as Behavior Towards Risk, 25 Rev. Econ. Stud. 65 (1958).

For those more accustomed to algebra, consider the following example: Assume that the risk-free return is 8%, that the expected return on a low beta (0.5) stock portfolio is 12%, and that the expected return on the market portfolio (beta = 1.0) is 20%. An investor seeking a risk level (or beta) of 0.5 can improve on the 12% expected return available from a portfolio solely of risky assets by putting half her funds in the market portfolio and half in risk-free assets (Treasury bills, e.g.). Her expected return from such a portfolio is 14%. \((0.5 \times 0.08) + (0.5 \times 0.20) = 0.14\). For further discussion, including an examination of current assumptions about taxation and ability to borrow at the risk-free rate, see R. Pozen, supra note 6, at 158-61, 165-69.

Though the above argument indicates that the "standard" CAPM implies that every investor holds the same portfolio of risky assets, more sophisticated "nonstandard" models entail some variation in portfolios. See the discussion of Black's model at notes 53, 88 infra. In these nonstandard models, the market portfolio will not be the uniquely efficient portfolio of risky assets.

47 See Appendix A at text accompanying notes 200-20 infra.
garding the efficient market hypothesis. As with the filter tests, however, these recent tests are "joint tests" and could therefore lead us to abandon either the EMH or CAPM.

There are strong reasons to reject CAPM rather than EMH. First, many of the contradictory tests are public announcement tests. Because much publicly available information can be acquired costlessly, one would expect prices to reflect this information. Second, CAPM itself depends upon an efficient market assumption, because the assembling of efficient portfolios requires an accurate assessment of risk and expected returns for individual securities. Third, EMH is highly desirable from a policy perspective. Securities markets that are not speculatively efficient are unlikely to be allocatively efficient. Allocatively inefficient capital markets present important and perplexing policy problems.

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48 See Appendix A at text accompanying notes 221-45 infra.

49 There is another assumption made by EMH tests using CAPM: "rational expectations." CAPM asserts that expected returns from a security are linearly related (through beta) to expected returns on the market portfolio. Unfortunately, expectations are not readily observable. Therefore, tests using CAPM almost always adopt the rational expectations assumption: that investors' expectations are correct. Thus the distribution of actual returns is adopted as investors' expectations.

Rather than rejecting EMH or CAPM it is tempting to reject instead the rational expectations assumption. First, the rational expectations assumption itself implies that investors share ex ante beliefs about the distribution of future prices. Such a presupposition, however, contradicts naive observations and the widely held view that differences and changes in beliefs are, along with differences and changes in endowments and risk preference, the occasions for trade. On the other hand, the homogeneity presupposition is necessary for CAPM itself: if investors had different beliefs, each would identify a different portfolio as efficient. The measure of the beta of a given security would then vary from individual to individual (because beta is a measure of volatility relative to the most efficient portfolio). See also Appendix B at note 247 infra.

The second and most important reason for rejecting the rational expectations assumption arises from a paradox that we will address below: namely, that investors will pay for information that the market provides for free. Despite these difficulties, however, abandoning the rational expectation assumption would prove problematic. Because expectations are difficult to observe, virtually every empirical test requires the assumption. Two published studies have attempted to observe actual expectations, J. Cragg & B. Malkiel, Expectations and the Structure of Share Prices (1982) (using analysts' forecasts); Friend, Westerfield & Granito, New Evidence on the Capital Asset Pricing Model, 33 J. Fin. 903, 906-08 (1978) (surveying institutional investors), and some institutions may study their own expectations, see W. Sharpe, supra note 36, at 315-19 (discussing Wells Fargo Bank).

50 How can the desirability of a theory affect our acceptance of it? Recall that the tests of EMH are joint tests with CAPM (and the rational expectations hypothesis). While at least one of them is false, our research strategy may be affected by which one we think most likely to be false and by which one we understand to be most central to our research program. See I. Lakatos, Falsification and the Methodology of Scientific Research Programmes, in 1 Philosophical Papers (J. Worrall & G. Currie ed. 1978). Our strategy for formulation of legal policy should admit similar concerns.

51 See, e.g., E. Fama, supra note 19, at 133: "An efficient capital market is an important component of a capitalist system . . . . [If the capital market is to function smoothly in allocating resources, prices of securities must be good indicators of value.]"
Nevertheless, we shall argue below that compelling reasons require modification of EMH. 52

Critics have raised two significant objections to CAPM's reliability as a benchmark of normal returns: (1) they have challenged the accuracy and adequacy of the model; and (2) they have challenged the testability of the CAPM model.


While showing linearity, the studies also demonstrate significant discrepancies in the exact pricing of risk as predicted by CAPM. Based on the equation in note 44 supra, the "price of risk" may be written with somewhat simplified notation as follows:

\[ E(r_i) - r_i = \beta_i (E(r_m) - r_f) \]

The empirical work showed that the price of risk on security \( i \), the left-hand term, did not fit the data. The market appeared to undervalue risk. Moreover, the linear relationship varied from period to period and did not prevail in all periods. Thus, the studies have been viewed as rejecting the specific "one factor" CAPM model. See E. Fama, supra note 19, at 368. Black proposed a more complex model in the CAPM form that would substitute the return on a "zero-beta" portfolio (the efficient portfolio uncorrelated with the market portfolio) for the risk-free return. Black, Capital Market Equilibrium with Restricted Borrowing, 45 J. Bus. 444 (1972). Black's model fits the data more closely in direct CAPM tests and has frequently been used in other tests relying on CAPM. The shift to Black's model also has important implications for optimum investment policy, discussed at note 88 infra. For an intuitive account of the zero-beta CAPM, see E. Elton & M. Gruber, supra note 36, at 303-06. Moreover, because return on the zero-beta portfolio can vary (whereas the risk-free rate is regarded more as a constant), Black's model could account for periodic changes in the slope of the so-called "security market line." See S. Scheffrin, supra note 8, at 133-37.

Some researchers disbelieve CAPM's basic claim, and particularly doubt that market risk is the primary factor in asset pricing. E.g., Douglas, Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency, 9 Yale Econ. Essays 3 (Spring 1969) (variance of individual security returns better explains securities prices than beta); Friend, Westerfield & Granito, supra note 49, at 906-08 (showing that firm-specific risk is as significant in asset pricing as beta.

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52 See text accompanying notes 66-83 infra.
models that considered variables in addition to market risk—for example, industry risk, asset size, the "skewness" of expected returns, the effect of taxes, or investor time horizons. Indeed, researchers produc-

measure); Levy, Equilibrium in an Imperfect Market: A Constraint on the Number of Securities in the Portfolio, 68 Am. Econ. Rev. 643 (1978) (for all but most widely held securities, variance of individual security returns provides a better explanation of price behavior than beta); Reinganum, A New Empirical Perspective on the CAPM, 16 J. Fin. & Quantitative Analysis 439 (1981) (returns on NYSE-AMEX stock portfolios with widely different estimated betas are statistically indistinguishable, suggesting that CAPM may lack significant empirical content). See also Ayres & Barry, Prologue to a Unified Portfolio Theory, 37 J. Fin. 625 (1982) (variance of individual firm cash flows (the internal rates of return) is key variable).

One source of the questioning of CAPM’s basic claim is recent evidence showing that individuals tend to hold undiversified portfolios. M. Blume & I. Friend, The Changing Role of the Individual Investor 46-50, 117-20 (1978); Blume & Friend, The Asset Structure of Individual Portfolios and Some Implications for Utility Functions, 30 J. Fin. 585 (1975). Of course, the significance of this finding in a market increasingly dominated by institutional investors who do hold diversified portfolios is doubtful. Researchers also note some of the serious technical problems in testing CAPM; in particular, the determination of beta proves troublesome. It is agreed that individual security betas are unstable over time, but that portfolio betas are very stable. Thus, CAPM tests generally rely on returns of portfolios of a particular beta. The problem, of course, is that “it is the returns on individual assets which the theory is trying to explain and individual asset deviations from linearity may cancel out in the formation of portfolios.” Friend, Westerfield & Granito, supra note 49, at 908. Another serious criticism of the grouping technique used in CAPM tests is Roll, Testing a Portfolio for Ex Ante Mean/Variance Efficiency, in Portfolio Theory, 25 Years After 135-49 (E. Elton & M. Gruber ed. 1979).


ing contradictory EMH studies frequently assert that CAPM is incomplete or "misspecified." In a survey of contradictory public announcement tests, Ball argued that CAPM neglected some important determinants of expected returns and that the earnings and dividends variables studied in the tests served as a "proxy" for the factors that had not been included.\(^5\) To use Ball's example, imagine an equilibrium returns model that did not account for securities' relative risks. An efficient market test would find dramatic differences in the securities' yields, suggesting significant excess returns from analysis of yields. But these differences would result from the observed variable (here, yield) substituting for an omitted variable (here, relative risk) in the "true" equilibrium returns generating process. In other words, the problem would lie not in EMH itself but rather in the particular equilibrium model used in the test. Thus, even if the first claim of CAPM—that there exists a linear relationship between market risk and expected return—is true, its failure to capture other important factors in asset pricing may make it an inadequate benchmark for EMH tests.

A second objection to CAPM is that it cannot be tested and thus may not be used to test other hypotheses.\(^6\) This argument is very complex, but the basic theme relates to the market index against which risk is

\(^{5}\) Ball, Anomalies in Relationships Between Securities' Yields and Yield-Surrogates, 6 J. Fin. Econ. 103, 111 (1978). The tests are discussed at greater length in Appendix A. Other CAPM tests have identified rather quixotic seasonal factors on stocks such as a "January Effect." See Tinic & West, Risk And Return: January vs. The Rest of The Year, 13 J. Fin. Econ. 561 (1984). Such factors seem likely to proxy for "real" variables in the return generating process.

measured. Tests of the model necessarily employ the wrong market index; the "true" market index, "M," contains all risky assets, such as real estate or gold held for investment, not simply those traded on well-organized securities markets.\textsuperscript{61} Tests of CAPM, however, cannot possibly employ "M" because it is not susceptible to measurement; instead, these tests rely on the Standard and Poor's (S&P) 500 or the Wilshire 5000 or some other index used as a proxy for "M," and the substitution gives rise to profoundly misleading results. This point is clearly illustrated by the observation of completely opposite outcomes in tests of comparative portfolio performance when the proxy shifts from the S&P 500 to the more broadly based Wilshire 5000.\textsuperscript{62}

A more fundamental objection to the above observation about "M" is that in its simplest form, CAPM amounts to a claim that the market portfolio is efficient. If "M" cannot be determined, however, then its efficiency cannot be evaluated and CAPM cannot be tested. Previous tests of CAPM are fatally flawed: the observed linear relationship between actual returns and market risk turns out to be nothing more than a mathematical tautology.\textsuperscript{63}

Whether CAPM is testable, and thus usable with confidence in any tests, is a matter of debate among financial economists.\textsuperscript{64} At the very

\textsuperscript{61} Indeed, nonmarketable assets, such as human capital (for example education), should be included in "M."


\textsuperscript{63} This is because when we examine the data "there will always be some portfolio which is ex-post efficient and will bring about exact observed linearity among ex-post sample mean returns and ex-post sample betas. If we do not know the composition of the market portfolio, we might by chance select a proxy that is close to mean-variance efficient." Roll, supra note 60, at 138 (emphasis in original). If it should happen that the market proxy is efficient, the results will be consistent with CAPM, and if the market proxy is not efficient, the results will be inconsistent, but in neither case will CAPM have been tested. For an additional proof of Roll's point, see Levy, The Capital Asset Pricing Model: Theory and Empiricism, 93 Econ. J. 145 (1983). The proofs are very complicated, but the reader may get some intuition from examining Black's CAPM equation, supra note 53, and noting the necessary relationship between the zero beta portfolio and the proxy chosen for the market portfolio.

\textsuperscript{64} Compare, e.g., Cheng & Grauer, An Alternative Test of the Capital Asset Pricing Model, 70 Am. Econ. Rev. 660 (1980) (agreeing with Roll that all previous tests of CAPM have been ambiguous, suggesting that the problem is regarding beta as exogenous, not endogenous, and offering unambiguous test but finding evidence against CAPM); Elton & Gruber, Non-Standard C.A.P.M.'s and the Market Portfolio, 39 J. Fin. 911 (1984) (extending Roll's conclusions to all CAPM variations); Gibbons, Multivariate Tests of Financial Models: A New Approach, 10 J. Fin. Econ. 3 (1982) (offering another unambiguous test and rejecting CAPM); Shankin, Multivariate Tests of the Zero-Beta CAPM, 14 J. Fin. Econ. 327 (1985) (rejecting CAPM for equally weighted market portfolio, even correcting for firm-size seasonal effects); Tinic & West, supra note 53 (showing non-linear relationship between risk and return on various market proxies, even after correcting for firm-size effects and seasonal anomalies) with Stambaugh, On the Exclusion of Assets from Tests of the Two-Parameter Model, 10 J.
least it appears that an asset pricing model more sophisticated than CAPM is required. Moreover, as discussed below, adjustments to CAPM may have significant legal consequences for financial fiduciaries. Even if CAPM's basic claim is sustained, it seems an insufficiently sensitive instrument to conduct reliable tests for EMH or for other purposes. Independent reasons exist, however, to question and to reformulate our understanding of EMH. To this problem we now turn.

II

INFORMATION ACQUISITION AND EFFICIENT MARKETS

The efficient market hypothesis boldly claims that informed participants (except for corporate insiders who possess unique access to certain information) cannot outperform other market participants. Sweeping policy pronouncements flow from this claim. For example, legal rules should discourage institutional investors, acting as fiduciaries, from expenditures on securities research. But the claim also leads to a curious paradox: the market will remain efficient only if most market participants believe it is not and accordingly engage in the securities research necessary to create efficiency. This conundrum raises a third concern to complement those of speculative and allocational efficiency already noted. A market, efficient or not, should be in informational equilibrium: investors should not only lack incentive to change their portfolios, they should also have no incentive to change their information acquisition strategies.

The efficient market hypothesis makes two distinct claims: that all relevant information will be available to the market, and that the market rapidly digests all such information as soon as it becomes available. EMH makes no claim about the source of information reflected in the
price. Models of market efficiency relied upon in the legal literature treat the available information as exogenous by simply asking how the market will respond given a certain amount of information; they fail to account for individual decisions to obtain information. A better approach would regard the information set relative to which the market is efficient as endogenous; the efficient market hypothesis should be embedded in a general model that simultaneously explains both investors' decisions to acquire information and the process of market aggregation of information held by investors. By choosing legal rules or taking other actions on the basis of the partial models, policy makers may unwittingly interfere with both the process of information acquisition and the process by which this information is reflected in price.67

Only recently have economists begun to model these two processes jointly. Before discussing the different models, however, an examination of the concept of "information" as used in the efficient market hypothesis would be helpful. Market participants seek to predict at time \( t \) the return they will earn on their investment at time \( t + 1 \); in many cases this amounts to predicting the price at \( t + 1 \). Consider for example a stylized version of the future market for wheat. Traders must decide at time \( t \) on a contract for delivery of wheat at time \( t + 1 \). The profitability of a future contract for wheat at price \( p_t^f \) depends on the spot market price at time \( t + 1 \), \( p^s_{t+1} \). The spot market price in turn depends on the realized supply of wheat at time \( t + 1 \), uncertain at time \( t \), and the realized demand for wheat at time \( t + 1 \), which might also be uncertain at time \( t \). Future supply might be uncertain because weather conditions are uncertain or because, though the crop already has matured, its realizable size is not known with certainty. Demand schedules might be uncertain because the demand for wheat from the Soviet Union or other potentially large purchasers is not known at time \( t \). In an efficient market the future price and the spot price are related because the future price is the "best" unbiased predictor of the spot price available given all the information known by market participants.68

Anything that assists a trader in predicting the spot price of wheat constitutes "information." Information in this broad sense might be costly in two different ways. First, it might be costly to acquire "elementary" bits of information. In our example, investors might seek facts about soil conditions, actual crop yields of selected domestic growers, or

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67 Two recent articles consider the process by which markets become efficient. Easterbrook & Fischel, Mandatory Disclosure and the Protection of Investors, 70 Va. L. Rev. 669 (1984); Gilson & Kraakman, supra note 5.

68 Thus, if investors imagined that the factors affecting variations in the crop and variation in international demand were constant over time, \( p^s_t \) represents the average spot price realized over many periods.
pictures of Soviet grain fields. Acquisition of these facts may require vast expenditures of resources. Second, one might strive to understand the process by which these various elementary facts combine to determine the spot price. In some sense this process might entail no more than determining how particular facts determine the supply of and demand for wheat. These calculations seem easy to perform in the simple example described above, but in the complicated markets of the real world such calculations often prove complex and expensive. For instance, an investor might make the elementary observations that the rice crop was unusually large and the potato crop unusually small. Because wheat, rice, and potatoes all substitute partially for each other among consumers these two facts influence the demand for wheat. Predicting this combined effect on the demand for wheat, however, is a difficult and expensive task.

A model of both information acquisition and price determination must explain how investors decide the nature and amount of information to acquire. An economic model will assume that investors make these decisions by comparing the costs of acquisition to the benefits from the information (extra trading profits). The costs will vary with the nature of the information. Some information may be virtually costless to obtain. One can easily obtain the past prices in a market by simply reading the newspaper daily and recording the price. Thus, obtaining the "elementary" information necessary for technical analysis is virtually costless.69 We might therefore expect large numbers of market participants to share this information. Other information—about the size of the crop or the size of substitute crops or the size of the Soviet harvest—may be very difficult to obtain. Traders will expend resources to obtain this information only if it is profitable. So, if learning about the Soviet harvest allows the trader to determine that future contracts for wheat are undervalued (i.e., the future price of wheat is lower than the expected spot price), the trader could profit through the purchase of future contracts. Conversely, if the information about the Soviet harvest showed that future contracts were overvalued, she could profit by selling short.

The effects of an efficient price determination mechanism on incentives to acquire information depend on how one models the investor's decision to acquire information. In the previous paragraph we assumed that the extra information allowed the investor to identify under- or over-valued future contracts. In an efficient market (as conventionally defined), she would be unable to profit from the acquisition because the future price of wheat would instantaneously reflect the information about

69 Technical analysis examines trends in past prices in order to determine what securities to purchase.
the Soviet harvest that the trader had acquired. The impact of market efficiency on the investor's information acquisition decision, then, depends on whether she recognizes that the market is efficient. If she assumes that the market is inefficient, she would expect to earn extra profits (though she may fail to do so), and thus would acquire the information. If she believed that the market was efficient, however, she would recognize that she could not profit from acquiring the information, and therefore would lack any incentive to acquire costly information.

The two models of information acquisition thus assume different levels of investor sophistication. In "naive" models, the investor does not recognize that markets are efficient. Consequently she does not use the market price to infer information about the value of the securities. Thus, prices serve only as budget constraints. The size of the portfolio purchased is limited by her own wealth and the prices of the securities. In "sophisticated" models, the investor knows the market price is efficient and "fully revealing." Hence, she can infer from the price as much information about future returns at time $t+1$ as someone who had engaged in painstaking research. For the sophisticated investor, prices serve two functions: they constitute budget constraints and they convey information about the securities' values.

While the concept of efficiency in both the naive and the sophisticated models conforms to the basic definition of efficient markets provided above, in neither model, as required by the conventional definition of efficiency, can an investor make trading profits. The naive trader believes she can make trading profits but cannot. The sophisticated investor knows she cannot make trading profits. This knowledge leads to a paradox in the sophisticated model. As a result of the sophisticated trader's knowledge, she will not acquire costly information. If she fails to acquire any costly information, however, the market might fail to be efficient. Acquisition of costly information would then be a profitable endeavor. An equilibrium of both efficient security prices and decisions to acquire information would not exist.\footnote{It is also possible that the market remains efficient as to the information acquired because available information would be accurately reflected in price, but security prices would carry very little information.}

No such equilibrium paradox besets the naive model, but that model manifests its own inconsistencies that it will repay us to consider.

Naive models suffer from two related flaws that may be understood more clearly in the context of a particular model. We shall consider a model presented by Verrecchia.\footnote{Verrecchia, Consensus Beliefs, Information Acquisition, and Market Information Efficiency, 70 Am. Econ. Rev. 874 (1980).} In Verrecchia's model, each investor may choose to learn something about the expected value (or mean) of the

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\footnote{It is also possible that the market remains efficient as to the information acquired because available information would be accurately reflected in price, but security prices would carry very little information.}

\footnote{Verrecchia, Consensus Beliefs, Information Acquisition, and Market Information Efficiency, 70 Am. Econ. Rev. 874 (1980).}
distribution of future prices. She will use this information to adjust her beliefs about prices and thereby affect her portfolio choice. The effect on her portfolio choice depends, then, on her initial beliefs about possible future prices. A sophisticated investor would have "rational expectations": her beliefs about the distribution of future prices would be correct. In Verrecchia's model, however, the investors are naive; they have inaccurate beliefs about the mean price. Verrecchia justifies this assumption by noting that each investor is a price taker and therefore she should not expect her actions to affect the price. In particular she should not expect the information she gathers to be reflected in the price.

The rational expectations assumption suggests the more fundamental objection to Verrecchia's assumption of naivete. Investors repeat the process of portfolio adjustment every period. After many periods they should notice that their naive belief (that the price does not reflect all available information) is wrong and that they are not earning a return on their research investments, or more precisely that they could improve their predictions by using the price of the security to predict future prices. If they made use of price in this way, they would discover that the information they acquired had no value. Hence, the naive investor is transformed into the sophisticated investor. This discovery should occur as long as the process that generates prices is stationary. If the process changes from period to period, investors will not learn the true distribution because it will change constantly. Further, if the process is not stationary, the inference problem for the naive investor also grows more difficult.

A second, related problem arises in Verrecchia's model. The model assumes that investors do not believe that price carries information about security values. No one then should be interested in technical analysis of past prices because it assumes that one can infer future prices from ob-

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72 A market participant is a price taker if, when he makes his decisions, he assumes that his actions will not affect market outcomes. In competitive markets, each participant purchases or sells only a very small part of the market and hence his decisions have no (or very little) effect on market price and quantity traded. We generally assume that participants in competitive markets understand that their decisions have little effect and hence make their decisions without calculating market responses to their acts. In particular, each consumer in a competitive market is generally modeled as having an infinitely elastic (perfectly horizontal) demand curve.

73 Verrecchia, supra note 71, at 881.

74 More generally, lack of stationarity makes testing of hypotheses extremely difficult. In Verrecchia's model, investors know the form of the distribution and need only estimate its mean and variance. Nonstationarity might only change the mean and variance from period to period. If this is so, Verrecchia's model is adequate; but it might also change the distribution of returns. This is not the place to explain the importance of the stationarity assumption to asset pricing models generally (including CAPM), but "[w]ithout stationarity . . ., or some explicit model of nonstationarity, econometrics itself is in jeopardy and this seems too tragic to take seriously." Ross, supra note 60, at 890 n.5. See also Appendix B at note 247 infra.
serving past prices. While efficiency in Verrecchia’s sense is consistent with no technical analysis because whatever information carried by past prices might also be carried by fundamental\textsuperscript{75} information, investors do purchase technical analysis. Their behavior is inconsistent with the assumption.

Sophisticated models assume that investors realize that securities’ prices carry information about value. Investors use price to infer the future returns of securities. These models replace the problematic assumption of no learning made by naive models but they do so at the cost of gathering information. Investors can acquire information about future returns by either expending resources and gathering information, or observing the current price at no cost. Because the amount of information known by any participant in the market is endogenous (i.e., is a function of the expected gain), the efficiency paradox noted above arises. Let us consider this paradox in the context of the market for wheat futures. If no one acquired the information about the Soviet harvest, then everyone, including the “market,” could better predict the spot price by gathering the information. The efficiency of the market, however, discourages an investor from acquiring the information because no individual can secure the gains.\textsuperscript{76}

If choices that confront investors are analyzed, however, it is apparent that investors still may retain incentives to do research. Thus, effi-

\textsuperscript{75} Fundamental analysis is research into the value of an investment by analysis of market and investment-specific factors.

\textsuperscript{76} At first glance, the paradox seems to derive from the fact that everyone purchases on the same market so that the efficiency of the market seems to be a public good. Because the market is efficient, the acquiror of the information cannot prevent other people from appropriating the benefits of the information. All market participants profit equally. The theory of public goods suggests that there will be an insufficient level of goods in a market because of the free-rider problem. This problem may be explained as follows: because each person enjoys the use of the good regardless of how much she pays for it, each person, if asked how much of the good she would be willing to support, would understate her willingness to pay. Unfortunately, the situation is symmetric and society would purchase too little of the good.

One simple model of this problem is the prisoner’s dilemma game. This game, most simply described, consists of two players, each of whom has two possible actions (or strategies)—cooperate (\(C\)) or defect (\(D\)). The payoff to each player depends not only on his own strategy choice but also on the strategy choice of his opponent. We may represent the payoffs (Player I/Player II) by the following matrix:

<table>
<thead>
<tr>
<th></th>
<th>(C)</th>
<th>(D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C)</td>
<td>1/1</td>
<td>(-.5/1.5)</td>
</tr>
<tr>
<td>(D)</td>
<td>1.5/(-.5)</td>
<td>0/0</td>
</tr>
</tbody>
</table>

Each player has two strategies \(C\) (cooperate) and \(D\) (defect). Each player’s payoff from the game depends not only on his own strategy choice but also on the strategy choice of his opponent. For example, if Player I chooses \(C\) and Player II chooses \(D\), Player I receives \(-.5\)
cient markets do not have the property that the strategy "no research" is always best regardless of what other investors do (technically, "no research" is not a "dominant" strategy) or the property that "no research" is best given that all other investors are doing no research (technically, "no research" is not a "symmetric Nash equilibrium").

To begin we must consider possible investor strategies. In actual markets investor research strategies are quite complex. Decisions are required not only about the amount to spend, but also about how to divide it up: which securities to research and whether to do technical or fundamental research. Whether a securities market will be efficient or not depends on the joint, but independent, choices of all investors. Some patterns of research choice will lead to efficient markets while others will not. The pattern in the market today appears to produce a very high level of market efficiency, but we do not know what types of restrictions we can impose on research strategies without hindering the generation of an equally efficient market. For example, banning technical research might lead to an inefficient market if no amount of fundamental research could capture the information carried by past prices. (More likely the amount of fundamental research done might have to increase dramatically.)

For simplicity let us ignore the complications of allocating research funds. Instead assume that market efficiency depends only on the amount expended on research. Let \( R^* \) be the cutoff point; if more than \( R^* \) is spent on research the market will be efficient, otherwise not. Suppose that all investors are alike and each chooses a research level \( R' \), where \( R^i = 0 \) (no research) or \( R^i = 1 \) (a certain level of research). If the investor chooses no research, she pursues a diversification strategy by

and Player II 1.5. Each entry in the matrix first gives the payoff to Player I followed, after the slash, by the payoff to Player II.

Examination of this game situation reveals that Player I is always better off choosing the strategy \( D \). But the game is symmetric; Player II therefore is also always better off choosing strategy \( D \). Consequently, the outcome for both players is 0, which is worse than if they cooperated.

A strategy like \( D \) that is best regardless of what strategy other people choose is called "dominant." In public goods situations it is a dominant strategy not to contribute in the supply of the public good even though one desires the supplied good.

The equilibrium pair of strategies \((D,D)\) has another property. It is a "Nash equilibrium," which means that if Player I is using strategy \( D \), then Player II has no incentive to change his strategy, and similarly for Player I contingent on Player II's strategy choice. The pair \((C,C)\) is not a Nash equilibrium. If Player II is playing \( C \), Player I has an incentive to switch to strategy \( D \) to increase his income.

The text suggests that, in fact, the information paradox is not a free-rider or prisoner's dilemma problem. Rather, it is better modeled by a different game.

\(^{77}\) See note 76 supra.
selecting the market portfolio. (Any other strategy would be irrational. The investor would lose the benefits of diversification without gaining the possibility of selecting undervalued securities.) If the investor chooses to do research, she selects an "optimum" portfolio in light of the research information. In an efficient market, the investor will not outperform the market and her return will be reduced by research expenditures. But if the total amount of research by all investors (who face similar payoff matrices and the temptation to free ride) is not sufficient to produce an efficient market, then the investor could earn a return on her research expenditure.

We assume only that the payoff to the nonresearching investor in an efficient market exceeds her payoff when the market is inefficient. This assumption means that a pure diversification strategy is less profitable in an inefficient market than in an efficient one. We may represent the schema of this game in a matrix where the entries represent the payoffs to an individual investor. The game looks as follows:

<table>
<thead>
<tr>
<th>Investor Strategies</th>
<th>R</th>
<th>NR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result of choices of other investors</td>
<td>R &gt; R* - 1</td>
<td>-1</td>
</tr>
<tr>
<td>R &lt; R* - 1</td>
<td>&gt;0</td>
<td>&lt;0</td>
</tr>
</tbody>
</table>

The game matrix reveals that no research, R^i = 0, is neither a dominant strategy nor a Nash equilibrium (if each investor i chooses it). R^i = 0 is not a dominant strategy because, if few other investors do research, the resultant market inefficiency provides an opportunity to improve payoff through research. R^i = 0 is not a symmetric Nash equilibrium because, if everyone chooses no research, the total amount spent on research R will be less than R* and the market will be inefficient. Consequently, an investor could profit by doing research. Therefore, given that everyone else chooses R^i = 0 an investor j should choose R^j > 0.

For some payoff structures when the market is inefficient, this model

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78 The investor may actually choose to invest in a mutual fund or stock index in order to select closest to the market portfolio.

79 Market inefficiency will interfere with the investor's ability to create efficient portfolios (i.e., those consisting of securities whose returns covary in the optimum way). See notes 34-43 and accompanying text supra. Conceivably the investor could acquire the market portfolio, but would incur greater transaction costs in assembling such a large portfolio and might still not be able to solve the problem of deciding in what proportions to hold particular securities. In fact, we need only assume that in an inefficient market, the payoff to research exceeds the pay-off to no research.

80 Note that if all other investors have spent more than (R* - 1) on research, the market will be efficient when the last investor makes his unit expenditure on research since total research expenditures will be greater than R*.
will have a set of Nash equilibrium research strategies in which some but not all investors purchase research. In this simple model, the equilibrium cannot be symmetric in pure strategies; if each investor acts like every other investor then everyone must do research, or no one must do research, neither of which is in equilibrium. The equilibria must either be asymmetric, or in mixed strategies. In a mixed strategy equilibrium, each investor would choose with some positive probability to do research. As a result the market would be efficient with some positive probability. For equilibria in which the probability of doing research is high, markets would generally be efficient. Because some investors will undertake research expenditures only if they reasonably expect to earn a positive return, the market will, at times, be inefficient and those doing research will earn a return. Most of the time, however, the market will be efficient. A series of equilibria in which investments in securities research earn a competitive return will result.

A slightly more complicated model yields a few other interesting conclusions. Assume that investors vary in size. A certain amount of research costs all investors the same dollar amount, but on a portfolio dollar basis is much cheaper for the large investor. Thus the same research will produce a proportionately greater percentage return for the large investor. Then there is some critical size below which an investor does no research but above which investors will invest in research with some positive probability.

Thus far we have shown that rational investors will choose to invest in securities research if they are large enough even though the pattern of research investment leads, with high probability, to an efficient market. This does not imply that the aggregate amount of research is necessarily optimal. Thus, investors might frequently invest more in research than necessary for an efficient market. We might not be able, however, to introduce a legal rule that would improve the performance of the securities research market; no legal rule may exist which would lead investors to choose an aggregate level of research closer to the optimal one.

Three more comments about the model may be helpful. First, competitive markets are often described as those in which an actor need not consider the strategic implications of his choice. Thus, if securities research markets were competitive one might argue that investors need not take into account others’ research expenditures. Taken too literally this approach is obviously paradoxical. But assuming that each investor has some probability distribution over the amount of money the rest of the market will expend on research, then we may model each investor as

81 Returns to research may differ with size for another reason as well. There may be a high threshold amount of research necessary to exploit possible market inefficiency.
maximizing his expected income by his choice of research expenditure. Again, small investors will choose $R^i = 0$ but large investors will choose some positive research expenditure.

Second, this informal model suggests that the prohibition of securities research by institutional investors might have serious repercussions for market efficiency. Moreover, it questions whether a pure diversification strategy would be wise in the event that markets are inefficient. If markets are inefficient, our models do not predict that diversification will be a good strategy, nor do they predict that it will be a bad strategy. We have no asset valuation theory for inefficient markets.

Third, the existence of an equilibrium in this model depends on the benefit to an investor who purchases research on an inefficient market exceeding her benefit from an inefficient market when she purchases no research. If this ratio of benefits were reversed, no equilibrium would exist.

Recently economists have developed models that make precise the conclusions suggested by the informal heuristic model we have outlined. Grossman and Stiglitz provide a model in which a research market and a securities market simultaneously achieve equilibrium. In their model an investor must expend a certain amount to become informed about one aspect of the uncertainty as to the price of the security. In equilibrium, the price of the asset reveals only partially the information possessed by informed investors. Prices are only partially revealing because the investors are uncertain about two factors that influence prices—supply and demand—and the uncertainty about only one of these factors can be resolved by research. Uninformed investors who observe the price cannot tell how much of the price is determined by the unresolved uncertainty and how much by the events about which informed investors learned. Because price only partially reveals the information held by informed investors, they earn sufficient trading profits to compensate them for their expenditures. Profits to informed investors, however, are "normal." Informed and uninformed investors earn identical returns on their total expenditures (investments in securities plus investments in research) because securities research is a competitive industry. If informed investors earned more than uninformed investors, it would be profitable for some uninformed investors to purchase research. As more investors purchase research, the price grows more informative and the value of doing research declines. Conversely, if the uninformed earned higher profits than the informed, it would pay for some of the informed inves-

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tors to cease doing research. When the amount of research decreased, the profit to the informed would rise.

In Grossman and Stiglitz's model, it is important that the information acquired does not completely eliminate the price uncertainty. The future market for wheat discussed at the outset of Part II provides a convenient illustration. Grossman and Stiglitz require that investors be able to resolve uncertainty about either supply or demand but not both. If only one uncertainty, say that of supply, is resolvable, uninformed traders would be unable to distinguish variations in price caused by the known (to the informed investors) changes in supply from those price variations caused by the unknown changes in demand. The unresolved uncertainty is called "noise." The larger the impact the unresolved uncertainty might have on the price, the greater the noise. The greater the noise, the more valuable is extra information. Thus, if demand conditions may vary widely, the price conveys less of the information available to the informed traders. Similarly, as the cost of information acquisition declines, the price becomes more informative.

It may be helpful to restate the Grossman and Stiglitz model in terms we developed above. Because information is endogenous, not all relevant information will be available to the market. Prices therefore will not fully reveal information that is not available to the market through securities research, and those engaging in research can earn a positive expected return.

Both the heuristic game theory model and the formal analysis in Grossman and Stiglitz point to the same conclusion: we should not expect 100% "efficiency" from securities markets. Markets that are substantially efficient nevertheless afford investors the opportunity to earn competitive, positive returns from securities research. Thus the efficient market hypothesis, and the policy prescriptions that flow therefrom, must be understood on this basis.83

III
POLICY IMPLICATIONS

A. Market Efficiency and Regulation of Institutional Investors

Our survey of the theory and evidence of market efficiency has iden-
Efficient Markets

tified a number of serious problems in the application of the efficient market hypothesis to legal policy. First, a substantial body of empirical work questions whether even the most well-developed capital markets are efficient. Second, as a theoretical matter, it seems unlikely that markets will be efficient in any conventional sense. In markets with minimally sophisticated investors, the information relative to which we measure the efficiency of the market will be endogenously determined. Investors will determine the amount of information to acquire on the basis of the return they receive from information acquisition in comparison to the return they can earn simply from inferring future returns from prices. The endogeneity of information implies that the market can be efficient relative only to a restricted set of information and that it will be inefficient relative to more costly information.

Third, because of both empirical and theoretical problems with market efficiency, and for independent theoretical and empirical reasons, we doubt that CAPM accurately portrays the normal return generating process. Fourth, because efficient market tests are joint tests, doubts about CAPM as a benchmark of normal returns have undercut the empirical studies that are cited to demonstrate efficiency. If the measure of normal returns is inaccurate, we cannot infer that excess trading profits are impossible. These doubts apply with particular force to tests of mutual fund performance claiming that sophisticated investors spending considerable resources on securities research cannot outperform nonresearchers.

To understand the impact of these problems on policy formulation, consider the policies that we might decree for institutional investors and other financial fiduciaries in a world without such problems. If markets were efficient and the capital asset pricing model accurately predicted normal returns for securities, diversification would be the only reasonable investment strategy. All investors should identify the level of risk they wish to accept and choose an efficient portfolio that maximizes return given that level of risk. Where the investor could borrow or lend at the risk-free rate, that portfolio would consist of the market portfolio, as appropriately leveraged or unleveraged. Some research to determine whether smaller (than market) portfolios closely approximated full diver-

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84 See Appendix A at text accompanying notes 221-45 infra.
85 See text accompanying notes 77-83 supra.
86 See text accompanying notes 53-65 supra.
87 See Appendix A at text accompanying notes 208-20 infra.
88 See note 46 supra. The text refers to the standard CAPM model. If Black's "zero-beta" CAPM model is employed, optimal "passive" investment strategies would be more complex. This is because the zero-beta CAPM does not assume an investor can borrow at the risk-free rate, meaning that the market portfolio would not be the efficient portfolio for all levels of risk. This is illustrated as follows:
sification would be justified if the slight loss in efficiency were compensated by the decrease in transaction costs necessary to form and maintain that portfolio.\(^8\) For investors, such as mutual funds, who cannot readily borrow or borrow near the risk-free rate,\(^9\) and who seek greater risk than provided by the market portfolio, the task is to assemble the efficient

The efficient frontier becomes LABC. The market portfolio is on the frontier, but unlike the standard CAPM, it is not the optimal portfolio for all investors. Investors who wish a risk level below that provided by portfolio A should mix A with lending at the risk-free rate; for risks greater than B, by acquiring more of portfolio B through borrowing; for risks between A and B, by acquiring the appropriate portfolio of risky assets. The market portfolio loses its uniqueness as a guide for investment (although its identification remains essential for the model). Thus, translating the model's prescriptions into an appropriate passive portfolio strategy becomes problematic.

The matter becomes more problematic still if other "nonstandard" CAPM models are employed, such as a CAPM that looks at returns on an after-tax basis, or an inflation-adjusted CAPM. See generally Elton & Gruber, The Lessons of Modern Portfolio Theory, in B. Longstreth, Modern Investment Theory and the Prudent Man Rule (forthcoming 1986). Financial economists frequently criticize the legal literature in this area on grounds of overemphasis on the market index as the only appropriate portfolio of risky assets for the investor diversifying at a particular level of risk. The result holds only under the standard one-factor CAPM, with its artificial assumptions about borrowing at the risk-free rate.

\(^8\) See Langbein & Posner, Market Funds I, supra note 6, at 11 (suggesting significant loss of correlation with the market index due to diversification with significantly fewer stocks).

\(^9\) See Appendix A at text accompanying notes 215-17 infra (discussing limitations on borrowing by mutual funds). In general, financial fiduciaries are not permitted to leverage investments through borrowing. See, e.g., Restatement (Second) of Trusts § 227 comment f (1959) (purchasing of stocks on margin regarded as "speculation"). This fact may help explain the recent wave of corporate restructurings, in which debt is substituted for equity in corporate capital structures. Institutions that cannot attain their desired leverage directly may therefore show some preference for securities of highly leveraged firms.
portfolio of risky assets. CAPM makes this possible by postulating a linear relation between expected return and relative risk, and defines the risk of a security in an operational way. Thus, research expenditures to determine the covariance of the return of a given security with the return of the market are both necessary and justified. In short, the "unproblematic" truth of the efficient market hypothesis and the CAPM would dictate comparatively clear and succinct rules of prudent investment and securities research. Indeed, these rules, based on such an unproblematic world, have been the basis for recent legal policy-making proposals.91

How do these proposals change if we acknowledge the doubts outlined above? The discovery that efficient market theory is not necessarily true does not free the law from theory; rather it deprives the law of a coherent theoretical framework within which to evaluate policy proposals. In the absence of such a framework, we must at least make explicit the empirical and theoretical judgments we use in prescribing specific legal policies.

Suppose that information was exogenous (because investors are naive and will continue to engage in securities research without regard to returns) and markets were efficient but that the capital asset pricing model presented an inaccurate or unimplementable standard of normal returns.92 Diversification would still be the only prudent strategy to undertake, but criteria against which to appropriately diversify one's holdings at a specific level of risk would be lacking, even if only an efficient proxy for the market portfolio were desired.93 One might then require

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91 See, e.g., Junewicz, supra note 6 (proposing pension plan disclosure of investment risk as measured by beta to enable participants to choose desired risk level); Langbein & Posner, Market Funds I, supra note 6, at 14-18 (suggesting that trustees should buy shares in a mutual fund or a market fund rather than try to choose particular stocks); Langbein & Posner, Market Funds II, supra note 6, at 21-23, 28-31, 33-35 (supporting the use of passive investment strategy, commingling of small accounts, and deviation for trusts with few securities); Langbein & Posner, Social Investing, supra note 6, at 83-96 (questioning social investing on the grounds that it reduces diversification and adds administrative costs without increasing expected returns—a view of social investing that is significantly undercut by the move from the standard CAPM model to nonstandard models, because of the loss of a single efficient portfolio of risky assets); Pozen, Money Managers and Securities Research, supra note 6, at 949-53 (recommending presumptive permissive rules for portfolio management and purchase of securities research); Note, Broker Investment Recommendations, supra note 5 (advocating a mandated warning from brokers to investors disclosing that returns from portfolio theory strategy generally exceed stock-picking strategy).

92 See text accompanying notes 34-65 supra. Note that even if we believed CAPM to be a correct theory of asset pricing, the problem of devising an appropriate market index to measure relative risk could make it unimplementable.

93 Traditional trust doctrine provides a good illustration of the vagueness of the general prescription "to diversify" without a guiding theory. See, e.g., H. Bines, The Law of Investment Management ¶ 6.02[4] (1978); Restatement (Second) of Trusts § 228 (1959) (imposing a
fiduciaries to hold the entire market, but this requirement presents difficulties. It fails to identify the proportions in which each security should be held. It also prevents investors from conserving on transaction costs by holding less than the full market. The claim of efficiency alone is therefore not a sufficient claim on which to base legal policy making for financial fiduciaries. We need a separate asset pricing theory to evaluate and regulate fiduciary conduct.

Suppose that markets are not efficient though the amount of information known to market participants remains exogenously determined. Inefficiency has dramatic implications. Most immediately, diversification is no longer the sole prudent investment strategy. If market prices do not reflect available information, then an investor may identify misvalued stocks, potentially enabling her to earn a return above the return available through diversification at a given level of risk. Consequently, inefficiency would recommend the legitimacy of fundamental research if one believes that the underlying asset pricing model is tied to real economic characteristics of firms and that these real values are eventually reflected in financial markets.

Nonetheless, there are several notable complications to recommending fundamental research. First, if no generator of normal returns exists then we have no benchmark from which to test the relative efficiency of the market. An investor may have no basis for knowing whether it would be more prudent to pursue diversification or to hunt for above normal returns by investing in research. Second, without CAPM or another asset pricing model linking expected return to risk, it becomes very difficult to evaluate investment performance by fiduciaries. Thus the absence of a benchmark generator of normal returns implicates ques-
tions of performance as well as of efficiency. Third, if markets are not efficient, diversification becomes a problematic strategy not only because of the foregone opportunities from stock-picking but also because successful diversification requires the assessment of the “true” variation in expected returns.\(^9\) Market inefficiency interferes with this assessment. Fourth, an investor cannot earn above-normal returns simply by identifying over- or undervalued stocks. She must identify misvalued stocks that the market will in the (near) future value accurately or misvalue in the opposite direction. In discussions of misvalued stocks one frequently adopts the implicit assumption that the market eventually corrects its misvaluations. Absent an understanding of the process that generates market inefficiency and a standard of appropriate return, such an assumption lacks justification. An undervalued stock might remain perpetually undervalued in an inefficient market, in which case an investor will not improve her return by uncovering misvalued securities.

Finally, consider the problem of endogenous information. If we believe that investors are sophisticated, then the amount of information available to the market is not fixed. Investors will spend resources on research only if they can earn at least a competitive return. Though we might conclude from an examination of the empirical evidence that CAPM is false but still retain our faith in the efficiency of markets, endogeneity gives us a strong reason to believe that markets will not be efficient in any conventional sense. In the heuristic model we provide, the opportunity to profit from securities research is seen as a consequence of the strategic behavior of investors facing a matrix of possible choices and outcomes.\(^9\) In Grossman and Stiglitz, informed traders purchase information because prices do not fully reflect what they learn. They earn a competitive return on their research expenditures because they assume a position of superior knowledge compared to those who observe only price.\(^9\)

We shall examine the implications of endogeneity for legal rules governing fiduciary expenditures on research. In this discussion, we shall assume that misvaluations do not persist for long periods. Although no true model of the securities process exists to support this assumption, it conforms to intuitions shaped by the theory and evidence underlying efficient markets.\(^9\) The studies suggest that the opportunities to outperform the market via various filter strategies or more sophisticated strategies are limited if we accept CAPM as a first approximation of the

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\(^9\) See note 79 supra.
\(^9\) See text accompanying notes 77-82 supra.
\(^9\) See text accompanying notes 82-83 supra.
\(^9\) See Appendix A infra.
standard of normal returns.\textsuperscript{99}

In addition, we shall assume that as inefficiency increases, the returns to identifying misvalued stocks increase relative to the returns to diversification. Successful diversification requires the assessment of the \textit{true} variation in expected returns. Market inefficiency interferes with that assessment. The returns to diversification probably decline when the returns to securities research increase. Furthermore, a diversified portfolio will contain both undervalued and overvalued securities; the gains from one may counterbalance the losses from the other.

Finally, our discussion assumes that legal policy seeks to further two distinct social interests. Society desires that the most profitable real investment opportunities be funded first. This requires accurate signals of the valuation of different real production opportunities. Financial markets ideally provide such signals: if security prices accurately represent the valuation of production opportunities, such markets would be allocatively efficient.\textsuperscript{100} Moreover, we would desire that the market be efficient relative to as large an information set as was economic. Any information that improved capital allocation more than it cost to acquire that information should be acquired. Assuming that real and financial capital markets are linked, the law should select rules promoting the efficiency of financial markets relative to the optimal information set.

Rules governing institutional investors' expenditures on securities research bear directly on this social interest. Institutional investors hold a large percentage of assets traded on exchanges and represent an even larger proportion of those investors with portfolios of sufficient size to warrant substantial expenditures on research.\textsuperscript{101} Expenditures on security research by institutional investors will play a major role in any mechanism that leads to efficient markets. In this way, legal rules on research expenditures can affect the social interest in efficient markets.

The law also seeks to protect a second interest: that of beneficiaries of managed funds. This interest includes prevention of waste of fund assets on unnecessary research and trading costs. It also seeks to insure that the investment policies of managers yield the highest return for the level of risk selected. As will become more apparent in the following discussion, the legal interest in protecting fund beneficiaries produces an ambivalent attitude towards efficient markets. On the one hand, as we have seen, evaluation of investment policies is most feasible if markets are efficient. Arguably, efficiency identifies a single optimal investment

\textsuperscript{99} See id.

\textsuperscript{100} See text accompanying notes 10-16 supra.

strategy and, coupled with CAPM, suggests how that strategy should be implemented. At the very least, efficiency permits a benchmark strategy against which alternate strategies can be evaluated. On the other hand, to maintain efficient markets requires expenditure of funds on research that does not necessarily yield positive returns. The effect of this ambivalence is that every beneficiary would prefer that other beneficiaries bear the cost of maintaining efficient prices.

Three different approaches could dictate legal rules governing institutional investors that engage in securities research: (1) prohibition (a "must not" rule); (2) permission (a "may" rule); and (3) requirement (a "must" rule). More accurately, the last two approaches identify classes of rules. For instance, permissive rules might allow investors to decide unconditionally on the nature and amount of research to do. Or a permissive rule might be conditioned on disclosure of the nature and costs of the research or on the research's meeting some substantive requirement. Similarly, a research requirement might specify precisely the nature and amount of research each institutional investor must undertake or, alternatively, might permit some leeway in the research choices available to investors.

The previous discussion allows us to consider summarily a rule of prohibition. "Must not" rules make sense only if the efficient market hypothesis and CAPM are unproblematic and we assume that the institutional investor cannot benefit from any economies in transaction costs that might accrue from less than full diversification. The first of these conditions implies that the only prudent investment strategy is diversification at the selected level of risk.\textsuperscript{102} The last condition eliminates any need to calculate the optimal portfolio or to consider the possibility that slight losses in the optimality of the portfolio would be compensated by reduced transaction costs. The investor should simply purchase the market portfolio.\textsuperscript{103} Under these conditions, the beneficiaries' interest, which dictates that funds not be wasted on research that bears no yield to the fund, is protected. The social interest, under these same conditions, is unaffected by the rule. If the set of information reflected in prices in efficient markets is exogenously given, the absence of securities research on the part of institutional investors will not, by definition, alter the efficiency of the market.

Unfortunately, none of the prior conditions necessary to sustain a rule of prohibition prevail. At the very least, we expect that institutional investors would profit from research that allowed them to identify the

\textsuperscript{102} See text accompanying note 88 supra.

\textsuperscript{103} However, because nonstandard CAPMs, such as the zero-beta CAPM, seem more likely to hold, see note 88 supra, investors must calculate efficient portfolios other than the market portfolio.
efficient portfolio and to reduce transaction costs in the creation and maintenance of an optimal portfolio. Thus, at a minimum, our understanding of the operation of financial markets requires some type of limited permission rule. More importantly, if the amount of information available to the market is indeed endogenous, then a rule prohibiting research might dramatically alter the efficiency of the market. In this case, our heuristic discussion suggested that investors could then profit from research because they could identify misvalued securities. Moreover, because a must not rule would lock institutional investors into a diversification strategy, their beneficiaries would be disfavored relative to investors free to engage in research. Thus neither social interest would be promoted.

The dependence of the efficiency of markets on the research activities of participants provides the strongest argument for a must rule. A naive argument for such a rule would emphasize the importance of institutional investors in securities markets: absent research expenditures by them, we could expect neither to achieve the social interest of efficient markets nor to simplify the task of monitoring managers' investment strategies. Moreover, a must rule could allocate fairly the costs of maintaining efficient markets among beneficiaries: for instance, we might require institutional investors to purchase research in proportion to the size of the asset pool managed.

Four related difficulties beset these arguments for a must rule. First, if such a rule were implemented, beneficiaries as a class would bear the costs of maintaining market efficiency, a kind of tax. Direct market participants (those not investing through institutional investors) would escape this burden, although individual participants tend to be wealthier than beneficiaries.104 Second, the aggregate level of research expenditures would have to be determined. This might present a problem because too low a requirement would mean that markets may function inefficiently (particularly if we prohibit research expenditures in excess of the mandated amounts), while too high a requirement might insure efficiency but waste resources. Third, the must rule would have to provide criteria to guide the expenditures. At any given level of expenditure the investment manager may have no incentive to purchase the right information. Under a permissive rule, it seems reasonable to allow profit incentives to dictate research expenditures, but under a must rule, profit incentives may be dissipated. A must rule could outperform an unrestricted permissive rule only if the must rule reduced duplicate research expendi-

104 See, e.g., Pozen, Competition and Regulation in the Stock Markets, 73 Mich. L. Rev. 317, 357 n.256 (1974) ("[W]ealthy families own over 80 per cent of the market value of all corporate stock held by noninstitutional investors.").
Efficient Markets

Features that would occur in an unregulated market without reducing the amount of useful research. Neither courts nor administrative agencies, however, are likely to provide such accurate and precise research programs for institutional investors.

These last two difficulties point to a fourth problem with a must rule: What test will be used to guide institutional investors in the selection of mandatory research expenditures? Unless investors use a positive expected return test, attempt to discern information not already reflected in market price, and profitably exploit such information, we have no reason to believe that mandated research will lead to efficient markets. On the other hand, because the use of a criterion of positive expected returns appears to be in the self-interest of institutional investors, there is no reason to mandate such a rule. A must rule begins with the endogeneity assumption—that the amount of information reflected in prevailing prices is a function of research expenditures—but then misunderstands its implications. As our heuristic model demonstrates, sophisticated investors acting independently will adopt research strategies leading to a very high probability of a high degree of market efficiency.105

With an understanding that information is endogenously determined, the Efficiency Paradox does not support a mandatory rule for research expenditures in order to achieve the social interest in efficient markets. The Paradox arises out of a partial model of market efficiency that takes the size of the information set reflected in prices as fixed—a model that regards information as exogenous—and fixed at a level where returns to additional information-generating activity are nonexistent. Once it is assumed that information is endogenous, the Paradox disappears. In accounting for the research-generating activity of investors, the endogeneity of information explains why a must rule is unnecessary.

Therefore, some version of a permissive rule seems most appropriate. Assuming endogeneity and investor sophistication, we must first ask whether there should be any limitation on a permissive rule. The answer lies in the questionable ability of the beneficiaries of institutional investors to monitor performance. The endogeneity and sophistication as-

105 There may be a further, more limited claim lurking behind a must rule: That even for informationally efficient markets (markets where investors' research expenditures earn only a competitive return) there will be some information desirable for allocative efficiency that is so costly to gather that no single investor could expect to earn a positive return. Thus, an administrative agency might play a useful coordinating role in directing mandatory research expenditures for this purpose. To some extent this claim must motivate much of the government's extensive data collection, from crop forecasts to census-taking, and indeed, provides a basis for the mandatory disclosure requirements of the federal securities laws. A different version of this point is presented in Easterbrook & Fischel, supra note 67, at 680-87 (focusing on securities laws). Notice, however, how antithetical such a claim is to the premises of the efficient market hypothesis.
sumptions do not require that all institutional investors be equally adept at intelligent research decisions. As in any competitive market, some firms will be superior performers. A problem arises, however, if many institutional investors are significantly insulated from beneficiary monitoring and therefore survive despite wasteful research expenditures.

The classic response would be to adopt a rule of limited permission requiring institutional investors to report on the nature and expense of securities research. This rule relies on the market to police such research activity; a manager pursuing inappropriate research activity would face, in theory, a decreasing pool of assets. Such policing presumes that investors will be able both to evaluate the disclosed data and to move assets among institutional investors. These presumptions may be open to question. For example, many mutual fund shareholders invest through such an intermediary precisely because they lack the necessary sophistication to evaluate performance except on crudest terms and their small stake makes it irrational to develop greater sophistication. Beneficiaries of trusts managed by bank trust departments are frequently deemed incapable of investment management, may not yet be alive, or may be so numerous and possess such different interests as to make coordinated monitoring impossible.106 Moreover, trust instruments may make shifting among institutional investors very difficult. There are frequently similar capacity, coordination, and shifting problems for pension plan beneficiaries.107

In light of these problems, various limited permissive rules have been suggested that would impose specific substantive requirements on the investment manager. For instance, a rule might permit only research directed at optimum diversification, while prohibiting research that seeks to identify misvalued securities. A rule of such limited permission amounts to a rule of prohibition and the objections are the same as raised earlier. Given that information is endogenous, we have no assurance that such rules would maintain market efficiency, and if markets become (or are) inefficient, such rules might hurt beneficiaries relative to individual investors.

Another form of limited permission rule would prohibit (or discourage) certain kinds of securities research in light of a demonstrable inefficiency.108 Technical research is frequently placed in this category because

107 Current rules generally subject financial fiduciaries such as bank trust departments and pension funds to prudence tests while requiring only disclosure from mutual funds.
108 See, e.g., Pozen, supra note 6, at 953 (suggesting presumptive rules would tend to inhibit expenditures on technical and fundamental research while encouraging research for efficient diversification).
of the negative results of random walk and filter strategy tests. Even this limitation would be inconsistent with the endogeneity assumption. The history of securities prices must contain some information about future prices, otherwise market participants would not gather it. But because the information is relatively costless and widely disseminated, the opportunities for any particular investor to make substantial profits must be small. Precisely because of the relatively low costs of generating technical information and because of the uncertain effects of its elimination, there seems to be no reason to single it out for prohibition. Thus, it can be questioned whether there is any research that might properly be prohibited. For example, what about research into the sunspot cycle on the theory of a correlation with stock market turns? Or hiring an astrologer to help search for undervalued securities? These are not easy questions to answer. Suppose it is known that a significant group of investors believe in the sunspot theory. A better understanding of the cycle would give any investor (even a profound skeptic) a better chance of projecting future prices. The implications of this reasoning make it difficult to justify prohibitory rules.

Given the difficulties in formulating specific substantive rules, a general substantive rule imposing a standard of prudence may seem attractive. In an important sense, however, the "reasonably prudent person" test is circular. It may screen out the incompetent, but it does not tell the competent how to behave. What counts as prudent depends on our understanding of how markets function. The dictates of prudent investment a half-century ago—well-chosen stocks from legal lists and gilt-edged bonds—were presumably based on a theory of market operation. This theory viewed an individual investment as risky independent of its portfolio, and evaluated the risk of an individual security in terms of its legal claim rather than in terms of reasonable expectations of the security's income flow. Today we subscribe to the portfolio theory, which


110 We pursue the implications of this reasoning, based on the distinction between allocative and speculative efficiency, at text accompanying note 181 infra.

111 See Langbein & Posner, Market Funds I, supra note 6, at 4 (eighteenth- and nineteenth-century English and American judges and legislators had bias for "safe" investments, defined as long-term fixed-income government bonds or mortgages); Shattuck, The Development of the Prudent Man Rule for Fiduciary Investment in the United States in the Twentieth Century, 12 Ohio St. L.J. 491, 503-04 (1951) (collecting legal list statutes); Note, The Regulation of Risky Investments, 83 Harv. L. Rev. 604, 618 (1970) (state blue sky laws, federal margin requirements, and "legal lists" for trustees and financial fiduciaries derive from focus on risk of particular security, not portfolio); Note, Prudence in Trust Investment, 8 Mich. J.L. Reform
appears to account better for risk. Prudence demands that diversification be part of any reasonable investment strategy. Because we have no clear way to operationalize portfolio theory, however, the parameters of prudent diversification are not clear. Similarly, because our understanding of the mechanisms through which markets aggregate and (partially) reveal information is hazy at best, we cannot prescribe canons of prudence for the acquisition of information.

We can, perhaps, establish a rule of procedural prudence: that an institutional investor be self-conscious of its research strategy. Does it have a theory of market operation on the basis of which it operates? Does it monitor its research strategy to assess whether its research expenditures have been effective? Under its strategy, is the expected return from research expenditures equal to or better than the return from diversification? But such a comparison test depends on our ability to measure the return both from research expenditures and from diversification. Currently we can perform neither measurement with any confidence. Thus our ability to assess the efficacy of a rule of procedural prudence is questionable at best.

The problems we have encountered in trying to devise a limited permission rule arise from the difficulty in stating an adequate substantive rule to guide institutional investors, while lacking confidence in usual market policing. The usual model of market policing depends upon disclosure to and monitoring by beneficiaries. Such policing would be more effective if the model were restructured to include a professional monitor whose sole role was to evaluate investment performance, including expenditures on research. This monitor would be empowered to shift assets among institutional investors. In the bank trust department case, the policing problem arises because the trust function, which might be understood as selecting the appropriate level of risk for the trust corpus in light of the interests of various beneficiaries, is not separated from the investment management function. A limited permission rule separating those functions would make real monitoring possible.113

491, 503-04 (1975) (nineteenth-century bias against common stocks arose in part from undeveloped nature of security markets). The argument in H. Bines, supra note 93, ¶ 1.02[2][c], at 1-31 to -33, that rigid attitudes about investments stemmed more from doubts about competence of trustees than from the courts' "primitive understanding" of investment theory, seems improbable. If courts and other legal policy makers believed in the utility of diversification, why would they impose rules that they thought inevitably led to less than optimal results?

112 We might try to evaluate the prudence of research expenditures through comparative performance tests, requiring a prudent investment manager to perform approximately as well as the average manager. Whatever the problems with such a test for overall performance, see note 94 supra, it would not properly isolate the return to research versus the return to other aspects of investment strategy.

113 Separation of such functions is, of course, counter to traditional trust law's animus to the trustee's delegation of any part of his function. See B. Longstreth, Modern Investment
A separation rule already operates, to some extent, among institutional investors. For example, because of the pressure from the "prudent expert" rule of the Employee Retirement Income Security Act (ERISA), trustees of most large pension funds have not internalized investment management. Rather, they have employed managers in arms-length relationships and thus independently evaluate expenses and other performance. In theory, mutual funds also rely on separation of function for the policing of expenses. The "disinterested" directors of the fund must approve the advisory contract with the investment adviser. Many doubt the efficacy of this review, partly because the customary links between a fund's investment adviser and main underwriter make changing an investment adviser highly unlikely. Recent SEC rule changes permitting mutual funds to internalize distribution expenses arguably will enhance fund independence. Note should be taken whether these changes result in shifts of investment advisers on performance grounds.

In conclusion, the present state of financial economies must be frustrating for the legal policy maker. Theories of markets and investor behavior that were once embraced for their explanatory power and clear prescriptions now disappoint. This is not to suggest that portfolio theory should be abandoned, or that in competitive markets prevailing prices will not reflect a significant amount of relevant information. The modern finance paradigm may be "wrong" but may nevertheless provide genuine insights into market function, particularly if it seems to organize experience more effectively than existing alternatives. But rules ought not be

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115 The claim is frequently made that banks working for pension funds achieve superior results for the pension funds than for their trust departments. See, e.g., Use of Trust Account Assets Is Questioned In Bank of America Trial Set for Monday, Wall St. J., Sept. 21, 1984, at 8, col. 2. But cf. Pension Funds Feud With Money Managers Over Brokers' Rebates, Wall St. J., Oct. 4, 1984, at 1, col. 6 (difficulties of pension funds in constraining "churning" by money managers and in eliminating or recovering "soft dollar" elements of commissions).


established that lock in a false paradigm. The rules may come to have an independent existence in the legal culture, irrespective of the validity of their premises.118

B. The SEC and Market Efficiency

On an avowedly efficient market rationale, the SEC has recently enacted significant changes in the advance notice and disclosure requirements for the issuance of securities. Our analysis would not argue for significant changes in the SEC disclosure policy as adopted. This is partially because some of the changes do not rest on any strong claim about market efficiency. The SEC's use of efficient market notions is also not a procrustean application of the efficient market hypothesis, but rather an attempt to accommodate policy to actual market institutions. On the other hand, we think the SEC's elimination of advance notice requirements for certain securities offerings raises serious questions and warrants further investigation and perhaps modification.

1. Integrated Disclosure

In general, securities can be offered for public sale only if an effective registration statement, describing the issuer and the offering transaction, is on file with the SEC. The new SEC disclosure policy introduces abbreviated registration statements for two broad categories of securities issuers. Public companies believed to be widely followed by market analysts may use abbreviated registration statements to issue any securities—common stock or debt. Most other public companies may also use such abbreviated registration statements to issue “investment grade” debt or investment grade nonconvertible preferred stock. This abbreviated registration statement, called a “Form S-3,” contains information about the specific transaction (e.g., number of shares issued, price per share, use of proceeds, underwriters’ fees) but presumes that general information about the issuer will be known by the market through the issuer’s prior disclosure reports.119 The Form S-3 is one of the fruits of the SEC's

118 See J. Gordon, supra note 106 (contemporary courts are locked into outmoded conceptions of prudence because of authoritative commentary, situation of beneficiaries, and related trust law doctrines).

119 The integrated disclosure system was adopted in SEC Securities Act Release No. 6383, 47 Fed. Reg. 11,380 (1982), reprinted in Fed. Sec. L. Rep. (CCH) No. 956, extra ed. (Mar. 11, 1982) [hereinafter Release No. 6383]. The adopted system establishes three kinds of registration statements, successively more abbreviated. The “Form S-1” is not abbreviated at all. “Complete information about both the transaction and the registrant is required to be presented in the prospectus.” Id. at 11,383, Fed. Sec. L. Rep. at 19. The “Form S-2” permits substantial abbreviation of issuer information, requiring only what would be disclosed in an annual report, and indeed contemplating that in most instances the issuer would simply supply its most recent annual report. SEC Form S-2: Information Required in Prospectus, Item 11,
strenuous efforts to integrate disclosures for public offerings of securities required by the 1933 Securities Act with the disclosures periodically required of virtually all publicly traded companies by the 1934 Securities Exchange Act.\textsuperscript{120} In fashioning such an "integrated disclosure system" the SEC decided that the same or "equivalent" information would be material to investors in either trading or distribution transactions, then defined that information package and determined when and to whom dissemination of particular information was necessary.\textsuperscript{121}

For the SEC, the efficient market hypothesis justifies its Form S-3 policy as follows. Information contained in 1934 Act disclosures is widely disseminated through the financial press, is publicly available for reprinted in 2 Fed. Sec. L. Rep. (CCH) § 7143. The "Form S-3," as noted in the text, requires disclosure only of transaction-specific information, and does not require delivery of the annual report. Because the Form S-3 presents the efficient market questions most vividly, and for conciseness, the text disregards the Form S-2.

The practical effect of the disclosure scheme is to permit abbreviated registration for certain classes of securities. The actual regulatory scheme is, however, more complex. The Form S-3 may be used in the issuance of any securities—common stock or debt (whether or not investment grade)—by a company that satisfies certain requirements of the 1934 Act reporting system (filing all required reports for at least the preceding 36 months, timely filing of all such reports for at least the preceding 12 months, and no material failure to make preferred stock dividend or debt payments since the most recently filed audited financial statements) and that satisfies a certain public "float" test that marks it as widely followed. See text accompanying note 128 infra. A public company satisfying the reporting system requirements but not the public float test may register investment grade debt and nonconvertible preferred stock on the Form S-3 as well. 17 C.F.R. § 239.13(b)(2) (1985), reprinted in 2 Fed. Sec. L. Rep. (CCH) § 7152. Most publicly traded companies satisfy the reporting system requirements. The Form S-2 is also available to such companies for the issuance of any securities. 17 C.F.R. § 239.12 (1985), reprinted in 2 Fed. Sec. L. Rep. (CCH) § 7142.


free or at nominal cost, and, for at least a certain set of issuers, is closely studied by financial analysts and other sophisticated market participants. Therefore, such public information should be reflected in the price of the issuer's securities. There is no reason to repeat such information in either a registration statement or a prospectus delivered to investors for the sale of new securities. The only new unassimilated information accompanying a public sale is the specifics of the new issuance. Such "transaction-specific" disclosure is the focus of the Form S-3. SEC reliance on the efficient market hypothesis, however, may be unjustified. It is therefore useful to distinguish those aspects of the policies adequately justified by EMH from those that rely on other aspects or views of market operation.

Consider first the policies governing the issuance of equity. The SEC very practically delineated the class of companies eligible to use an abbreviated registration statement to issue common stock. Rather than condition eligibility on a determination of the efficiency of a particular market (such as the New York Stock Exchange), the SEC tried to identify those particular securities likely to be efficiently priced. The SEC acted on the theory that market efficiency results from the competitive research and trading activities of market participants. The SEC chose to use major investment institutions, such as large broker-dealers, as a proxy for market participants. After some informal evidence-gathering, the SEC decided on two alternative benchmarks for coverage by such participants sufficient to guarantee competitive market activities: companies whose public “float” (i.e., aggregate market value of outstanding voting stock held by nonaffiliates) exceeds $150 million, and companies whose public float exceeds $100 million and whose annual trading

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123 See SEC Form S-3: Information Required in Prospectus, reprinted in 2 Fed. Sec. L. Rep. (CCH) ¶ 7153 [hereinafter S-3 Required Information]; SEC Form S-3: Information Not Required in Prospectus, reprinted in 2 Fed. Sec. L. Rep. (CCH) ¶ 7154. In addition to transaction-specific information, the prospectus must also disclose any material change in the issuer’s affairs or certain restated financial statements not reported in, or appropriately incorporated by reference from, prior 1934 Act filings. S-3 Required Information, supra (Item 11).
124 Companies eligible to use a Form S-3 for registering equity can also use it for debt, see note 119 supra. Because of the role rating agencies and institutional and large corporate purchasers play in debt issuance, see text accompanying notes 145-48, this part of the text focuses on equity issuances.
volume exceeds three million shares.\textsuperscript{128} Using these criteria, the SEC estimated that approximately 32 percent of all companies listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), or NASDAQ (or 17.6 percent of all publicly reporting companies) would be eligible to use the Form S-3 for issuances of common stock.\textsuperscript{129}

In reading the SEC's analysis one could clearly disagree with the logic behind the precise line drawing. For example, approximately 1600 companies will be eligible to use the Form S-3, even though the SEC found that a typical major research firm follows only 300 to 500 companies.\textsuperscript{130} The SEC did not determine the identity of the companies regularly followed and the extent to which companies are followed by more than one firm. Nevertheless, the SEC sought a reasonable way to use newly developed insights about market performance to simplify disclosure requirements in the issuance of common stock. Most important, the attention to the functioning of actual marketplace institutions makes it unlikely that this change will interfere with market efficiency. Even if prices do not fully reflect all publicly available information, the use of abbreviated registration statements by widely followed companies will not restrict the competitive research and trading activity of firms and individual market participants.\textsuperscript{131}

Notwithstanding the announced reliance on efficient market theory,
much of the SEC's integrated disclosure initiative appears to take the theory as somewhat beside the point. For example, the SEC regards the abbreviated registration statements as explicitly "incorporating by reference" prior 1934 Act disclosure documents and, in the case of a delayed or continuous offering, disclosures that are subsequently filed (which are not explicitly added to the statement by a "post-effective amendment"). The efficient market hypothesis implies that prevailing prices fully reflect prior and subsequent disclosures, regardless of any explicit incorporation by reference. Thus, if the SEC were actually relying upon efficient market theory, it would regard incorporation as unnecessary.

Incorporation by reference is intended to serve another objective—verification of the disclosures by third parties who are subject to a legal liability rule. Sections 11 and 12(2) of the 1933 Securities Act impose liability on underwriters under a "due diligence" standard for material misstatements or omissions in a registration statement or a prospectus. Incorporation by reference is designed to put such disclosures "in" the registration statement and prospectus. Presumably, Securities Act liability will lead an underwriter of a new issue to verify disclosures, and thus arguably serves to police financial fraud.

class of stock are equivalent, the sophisticated investor knows what to pay for the new shares without access to a data base.

132 S-3 Required Information, supra note 123 (Item 12). The rules require explicit incorporation by reference and listing in the prospectus of virtually all 1934 Act reports (except proxy statements) beginning with the issuer's most recently filed Form 10-K (an annual report with extensive audited financial statements that is significantly more detailed than the annual report sent to shareholders) and including filings thereafter. The prospectus must also state that any subsequently filed 1934 Act reports (including proxy statements) will be deemed incorporated by reference into the prospectus until the offering is terminated.

133 See text accompanying notes 152-54 infra for a discussion of shelf-registration, which permits an eligible company to register on a single form all the securities it reasonably expects to offer over a two-year period, and then to offer ("take off the shelf") such securities at various times throughout the period.


135 Id. § 77l(2) (1982).

136 Section 11 covers registration statement misinformation, which will cover the preliminary and statutory prospectuses distributed to investors pursuant to section 10, 15 U.S.C. § 77j (1982), because the prospectus is filed as part of the registration statement itself. Section 12(2) specifically covers prospectus misinformation. See generally Scott, Resurrecting Indemnification: Contribution Clauses in Underwriting Agreements, 61 N.Y.U. L. Rev. (forthcoming 1986).


138 In order to reduce fraud, the assignment of liability must induce "independent" auditors to verify information provided by the company. The liability rule presumably gives the third
One question is whether the filing of a Form S-3 registration statement is necessarily the appropriate time for a special verification requirement. By comparison, the SEC does not require verification of other events that may prove more significant to investors than a new issuance—for example, the announcement of a significant change in anticipated quarterly earnings.\(^{139}\) Given the large public float of companies eligible for general use of a Form S-3, misinformation in such an announcement can easily cause greater damage to investors than misinformation in a registration statement.\(^{140}\) The incorporation by reference requirement, however, may be a tactic for verification for virtually all disclosures by a broad range of public companies. To this end, the SEC apparently contemplates that underwriters will engage in “anticipatory and continuous due diligence” for companies that have issued or may issue an abbreviated registration statement,\(^ {141}\) so as to verify both prior and subsequent disclosures. Thus, to avoid later problems, underwriters

\(^{139}\) The SEC appears to have virtually plenary authority under §§ 12(b), 13(a)-(b) and 15(d) of the 1934 Act, 15 U.S.C. §§ 78l(b), 78m(a)-(b), 78o(d) (1982), to regulate the content of periodic filings, including the extent to which financial statements must be audited and certified. Well-established principles of secondary liability applicable to accountants under section 10(b) of the 1934 Act, 15 U.S.C. § 78j(b) (1982), would presumably enhance the value of the verification. See, e.g., Ernst & Ernst v. Hochfelder, 425 U.S. 185 (1976) (accountants' liability under scienter standard). Similarly, through its control over the content of registration statements and prospectuses, see sections 7 and 10 of the 1933 Act, 15 U.S.C. §§ 77g, 77j (1982), the SEC can significantly expand or limit the extent of verification of a company's financial condition when it offers securities.

\(^{140}\) One might claim a special vulnerability for purchasers from a primary offering because of greater profits to underwriters on such sales than from ordinary brokerage transactions. Nevertheless, given the comparative sizes of the primary and trading markets, the total damage to investors from misstatements will almost always be greater for trading market participants.

may decide to undertake verification of each disclosure as it is made.\textsuperscript{142} Indeed, the SEC foresees that even before a particular underwriter is chosen for a prospective issue, a group of potential underwriters will retain a single counsel to represent them in due diligence activity.\textsuperscript{143} Ironically the only companies for whom this verification tactic may not work are those for whom it may be most critical: public companies whose financial position is so precarious as to deny them access to the public capital markets. In any event, the “centrality” of incorporation by reference in the new rules is driven by what the SEC believes will produce verification of disclosure, not efficient market theory.\textsuperscript{144}


\textsuperscript{143} SEC Release No. 6499, supra note 141, 48 Fed. Reg. at 52,892, Fed. Sec. L. Rep. at 86,340. The SEC also contemplates other activity, such as the holding of “drafting sessions” for prospective underwriters and the retaining of counsel prior to the filing of 1934 Act reports, in addition to periodic due diligence sessions between management and underwriters. Id., 48 Fed. Reg. at 52,893, Fed. Sec. L. Rep. at 86,340.

Note that “anticipatory and continuous due diligence” could lead to verification of disclosures not only for companies eligible to use the Form S-3, but also for companies using the Form S-2, i.e., virtually all publicly traded companies. Form S-2 contemplates delivery of the most recent annual shareholders report and incorporation by reference of subsequent 1934 Act filings. Further, the underwriters’ exposure to liability is virtually the same as for the Form S-3. The remaining question is whether the potential business from companies who could use Form S-2 is sufficiently great to lead underwriters to incur the expense of anticipatory and continuous due diligence. For a skeptical view on this point, see Fox, Shelf Registration, Integrated Disclosure, and Underwriter Due Diligence: An Economic Analysis, 70 Va. L. Rev. 1005, 1027-28 (1984).

\textsuperscript{144} The SEC does not claim that improved verification increases the allocational efficiency of markets by giving investors a better description of real economic outputs. Such a claim would depend on comparison of the costs of the new verification with the gains. For a spirited debate on whether the improved quality of information reaching investors that results from underwriter due diligence produces worthwhile benefits, compare Fox, supra note 143, at 1009-25 (arguing that it does), with Banoff, Regulatory Subsidies, Efficient Markets, and Shelf Registration: An Analysis of Rule 415, 70 Va. L. Rev. 135, 176-84 (1984) (arguing that it does not). Regardless of the wisdom of the SEC’s verification strategy, there is no inconsistency with the efficient market hypothesis in the desire for verification, contrary to the views of some commentators, see, e.g., Pickholz & Horahan, The SEC’s Version of the Efficient Market Theory and Its Impact on Securities Law Liabilities, 39 Wash. & Lee L. Rev. 943, 949 (1982). Even the proponents of the hypothesis concede that the market is not efficient with respect to inside information. E.g., E. Fama, supra note 19, at 166. For example, a company’s involvement in financial fraud is necessarily inside information until it bursts into the marketplace.
Other SEC policy objectives outweigh the efficient markets rationale in another context. The new rules permit virtually all public companies to register investment grade debt and nonconvertible preferred stock on the Form S-3. The new rules allow a company to use the Form S-3, so long as a recognized debt rating agency (such as Moody’s or Standard & Poor’s) rates the particular debt (or quasi-debt) security as “investment grade,” irrespective of whether the company meets the float or trading volume indicators of a widely followed company. The SEC claims that investors generally purchase high grade fixed income securities on the basis of yields and security ratings anyway. Justification of this regulation does not rely on the efficient market hypothesis for two reasons. First, the number of raters in the market seems to be small. The market thus appears insufficiently competitive to justify the conclusion that the rating reflects all, or nearly all, available information. Therefore, if use of the Form S-3 is appropriate, it is because the market relies on the rating agencies to investigate and assess the creditworthiness of the issuer. Market participants have presumably found it cheaper to rely on the rating agencies than to perform independent analyses, particularly where issuers’ debt is rated investment grade. Second, information other than a security’s investment grade should be relevant to an investor. The investment grade provides a point estimate of the bankruptcy risk of a company, a risk of particular interest to debt holders. But equity risk and information relevant to equity is also relevant to the debt holder. For example, if a company were to suffer losses in successive quarters, the probability of bankruptcy increases. Therefore, it is not obvious that the investment grade is an adequate summary of the information an investor wants.

Further, the new rules also permit the use of the Form S-3, irrespective of the float or trading volume of the issuer, in areas such as secondary offerings and rights offerings. The SEC’s use of abbreviated
registration statements in such instances is inconsistent with the efficient market theory. In the case of a secondary offering (for instance, offerings of outstanding securities for the account of a person other than the issuer), the investor is in the same position as if she were purchasing directly from the issuer. If we suspect that the market may not price the particular issuer’s securities efficiently, the investor will need the prior disclosures. The comparison the SEC draws between this investor and one purchasing shares of the same issuer on the trading market goes too far; it would equally justify permitting all companies to use the Form S-3 for equity securities. The SEC has simply decided that capital formation will be best served by a rule permitting an insider easy exit, and thereby the agency has trumped its efficient market theory.  

2. Shelf Registration

The SEC’s most controversial application of its efficient market theory arises in the context of security offerings permitted under its “shelf-registration” rule, Rule 415. Rule 415 permits a company to register securities for “continuous or delayed” offering over a two-year period provided that it is eligible to use Form S-3. This means that under Rule 415, a company may register in advance all the securities (debt or equity) it reasonably expects to offer and sell during a two-year period, and during that period “take off the shelf” any of such securities for immediate

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sale. No advance notice or waiting period is required. In light of the Form S-3 eligibility requirements discussed above, virtually any public company will be permitted to issue investment grade debt (or nonconvertible preferred stock) on this basis. Companies meeting the float and trading volume tests may shelf-register equity (and any debt).\textsuperscript{153} Thus Rule 415 provides companies with significant flexibility to locate propitious moments, or "market windows," for the sale of particular securities.\textsuperscript{154}

The SEC rationale assumes that security prices accurately reflect information available in the market, and that new information supplied on the Form S-3 will be reflected \textit{rapidly} in the price. If the SEC is correct in assuming that purchasers of investment grade debt securities (and nonconvertible preferred) care only about rating and yield, sales of debt (or such preferred) off the shelf present no particular information problem.\textsuperscript{155} At the time of their investment decision these purchasers (who are generally institutional or large corporate investors) will know this relevant information. On the other hand, when shelf-registration of equity securities is in issue, the speed with which the market assimilates the information grows in significance.

In its adoption of its three-tiered registration system, the SEC refused to make Form S-3 filings automatically effective. The SEC proposed instead that administrative discretion be exercised in light of the need to assure that all information, including information incorporated by reference, "is publicly available and assimilated by the market."\textsuperscript{156} The minimum period for SEC review of a Form S-3 registration statement appears to be forty-eight hours. Yet shelf-registration contemplates

\textsuperscript{153} Such debt securities may include non-investment grade debt. See note 119 supra. For simplicity, and because most corporate debt is acquired by institutional or large corporate investors, the discussion is cast in terms of equity offerings.

\textsuperscript{154} Taken literally, the notion of a "market window" is inconsistent with the efficient market hypothesis. A company cannot generally predict the future course of its stock price or interest rates. The phrase actually refers to the particular price or interest rate at which the company is prepared to issue securities. The company wants to move at these breakpoints, despite the possibility of future market improvement, because of the possibility of market deterioration. The company's desire to move quickly reflects a form of risk aversion.

A debate rages between investment bankers (who generally opposed shelf registration) and issuers as to whether the rule increases or decreases new issue costs, and whether the overhang from shelf-registered securities depresses the price of a firm's outstanding shares. A recent study of new common stock issuances on the NYSE and the AMEX from March 1982 through December 1983 indicates that the issuing cost of equity securities sold under Rule 415 is approximately 13\% less than a comparable syndicated offering, and rejects significant overhang effects. Bhagat, Marr & Thompson, The Rule 415 Experiment: Equity Markets, 40 J. Fin. 1385 (1985).

\textsuperscript{155} A similar argument could be made for the debt, even if not investment grade, of the companies meeting the float and trading volume tests.

that once a Form S-3 is effective, equity securities may be sold virtually immediately after announcement of the offering. This is so even when material or fundamental changes in the company have occurred after the filing of the registration statement (so long as such changes are reflected in periodic reports under the 1934 Act, which are incorporated by reference into the Form S-3).\textsuperscript{157}

Thus the shelf-registration rule may require a much stronger claim about market efficiency than the claim underlying the use of abbreviated registration statements generally. The rule assumes that the markets will all but instantaneously digest new information about the shelf offering, such as the number of shares offered of a particular class of equity, with particular dilutive effects on corporate control and earnings, and any other information signaled by the new issuance.\textsuperscript{158} The empirical work does not support such an efficiency claim. Because of technical difficulties associated with daily price movements, much of the empirical studies of market efficiency use monthly time intervals or, occasionally, weekly time intervals.\textsuperscript{159} Recent empirical studies focusing on daily price changes in response to company announcements suggest that such new

\textsuperscript{157} Rule 415(a)(3), 17 C.F.R. § 230.415(a)(3) (1985), reprinted in 1 Fed. Sec. L. Rep. (CCH) ¶ 3383, in combination with the cross-referenced Regulation S-K, requires a shelf registrant to update the registration statement with any new information about the offering (such as the specific terms of a new debt issue) or which amounts to a "fundamental change in the information set forth in the registration statement." Such updating may occur either by a post-effective amendment or automatically if included in a subsequent 1934 Act filing (because such filings are incorporated by reference into a Form S-3). Regulation S-K, Item 512(a)(1). 17 C.F.R. § 229.512(a)(1) (1985), reprinted in 6 Fed. Sec. L. Rep. (CCH) ¶ 71,062; S-3 Required Information, supra note 123 (Item 12(b)).

\textsuperscript{158} Recent empirical and theoretical work suggests that announcement of a stock issue is associated with a drop in the corresponding stock price because management acting for current shareholders will be reluctant to issue stock when it believes the firm's assets are undervalued by the market. See e.g., Asquith & Mullins, Equity Issues And Offering Dilution, 15 J. Fin. Econ. (forthcoming 1986) (empirical analysis); Krasker, Stock Price Movements in Response to Stock Issues under Asymmetric Information, 41 J. Fin. 93 (1986) (theoretical analysis). For a summary of factors bearing on stock price changes upon announcement of a new issuance, see Bhagat, The Effect of Pre-emptive Right Amendments on Shareholder Wealth, 12 J. Fin. Econ. 189, 295 (1983).

\textsuperscript{159} The determination of abnormal returns from announcements generally involves a returns generating model, such as CAPM, which assumes that price changes are "normally" distributed, i.e., according to a familiar bell-shaped distribution. See Appendix A infra. Monthly returns are very close to being normally distributed; daily returns are not. E. Fama, supra note 19, at 21-35. Moreover, nonsynchronous trading makes the estimation of key parameters such as systematic risk difficult on a daily basis. Scholes & Williams, Estimating Betas from Nonsynchronous Data, 5 J. Fin. Econ. 309 (1977). But see Brown & Warner, Using Daily Stock Returns: The Case of Event Studies, 14 J. Fin. Econ. 3 (1985) (technical problems of daily data can be corrected for or do not affect outcomes; daily data may be empirically more powerful). Other less precise techniques may also be used: for example, measuring abnormal daily returns on the assumption of a constant return model, or examining volatility effects of specific announcements (i.e., the period and extent of significant increases in
information is digested over a two-day period.\textsuperscript{160} Moreover, when a shelf offering is of a new class of a company's shares, a market efficiency argument may not be sustainable. At the time of the offering, there is no "prevailing price" for such shares. An investor will have to make a complicated decision based on the rights and privileges of this new class of securities, as well as information reflected in prevailing prices of previously issued classes.\textsuperscript{161}


There is a separate body of empirical work considering market efficiency with respect to daily or even intraday price movements, but these "weak form" tests are generally limited to finding correlations of price movements on which to base a trading strategy. E.g., Dann, Meyers & Rabb, Trading Rules, Large Blocks, and the Speed of Price Adjustment, 4 J. Fin. Econ. 3 (1977); Grier & Albin, Nonrandom Price Changes in Association with Trading in Large Blocks, 46 J. Bus. 425 (1973). See Appendix A infra.

\textsuperscript{160} E.g., Foster, Quarterly Accounting Data: Time-Series Properties and Predictive-Ability Results, 52 Acct. Rev. 1, 17 (1977) (quarterly earnings announcements); Hite & Owens, Security Price Reactions Around Corporate Spin-Off Announcements, 12 J. Fin. Econ. 409, 435 (1983) (spin-off announcements); Morse, Price and Trading Volume Reaction Surrounding Earnings Announcements: A Closer Examination, 19 J. Acct. Research 374, 382 (1981) (quarterly and annual earnings announcements); see also Pastena, Some Evidence on the SEC's System of Continuous Disclosure, 54 Acct. Rev. 776, 782 (1979) (suggesting that strong market reaction to Form S-K extends over three-day period); Patell & Wolfson, The Intraday Speed of Adjustment of Stock Prices to Earnings and Dividend Announcements, 13 J. Fin. Econ. 223 (1984) (while new dividend and earnings information causes price changes within minutes, price effects may persist over two-day period). One serious technical problem with many of these studies is the difficulty of determining the exact day on which an announcement was publicly released, and whether the announcement occurred at the end or beginning of a market day. For instance, the Morse study noted that the most significant price changes and excess trading volume of a particular security occurred on the day prior to and the day of the official announcement. The study concluded that the activity the day prior to the announcement could be due to a misspecification of the public announcement because the exchange would often receive the information on the day before the public announcement. Morse, supra, at 382.

\textsuperscript{161} One way to approach this problem is to imagine the help that the market gives to investors in determining the right price to pay for a security. For a typical trading market purchase of ordinary common stock of a widely followed company, the investor knows that the prevailing price is probably the right price (i.e., the price that fully reflects all available information). For a purchase from a shelf-offering of similar such stock, the investor knows that the market's prevailing price is probably the right price for the newly issued (but wholly fungible) shares. (This assumes that sufficient time has elapsed since announcement of the offering for the market to digest this new information.) The shelf-offering of a new class of a company's stock presents a different problem. A right price has not yet been established in the market. Every investor will have to determine the right price using information reflected in prevailing prices of the company's already traded issues plus information about the new security. This may take additional time. A similar argument could be developed for the shelf-offering of shares of a class of stock previously issued but only thinly traded, thus raising similar questions for successive issuances from a shelf-offering of a new class of stock. Another similar argument could be developed for noninvestment grade debt or preferred stock, which may be shelf-registered by companies generally eligible to use the Form S-3, where bankruptcy risk might be sufficiently great to require sophisticated analysis.

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efficiency perspective? It is important to consider this question in light of the particular distribution techniques available in a shelf-registered offering. The technique that appears most popular thus far is the so-called "bought deal," in which one or two large investment banks purchase the entire offering. The banks then quickly resell the securities, generally to institutional investors, to avoid the possibility of an adverse market move. The purchasers of the securities, the banks and the institutional investors, are the most sophisticated investors in the market. Presumably if they feel they lack sufficient information, or time to assess information, they will refuse to purchase securities. The only parties who may be adversely affected by the shelf-offering are open market participants, who may suffer some temporary uncertainty in the "right" price for the company's shares. But the announcement of a shelf-offering will cause no greater uncertainty than many other important corporate developments, such as an earnings change announcement or the announcement of a standard public offering. Such uncertainty we normally expect open market participants to bear.

The other likely distribution technique for shelf-registered equity is the "at the market offering," where a company sells shares directly into an open market through a stock exchange or a market maker off the exchange. The purchasers from such an offering need not be institutional investors. Rule 415 does limit the availability of this technique in a somewhat protective way: the offered securities must be of the same class as already traded securities. Thus if there is sufficient time for the market to assimilate the new information about the shelf offering, the prevailing price in the trading market is probably the "right" price for the newly offered securities (because the securities are fungible). But this poses the efficient markets question directly: given the short time periods between announcement of a "take down" from the shelf and actual distribution, is it reasonable to think that prices will fully reflect this information? Or, rather, will investors who base investment decisions only on prevailing prices be systematically disadvantaged vis-à-vis traders and institutions who may have independent means to assess new information?

162 See Banoff, supra note 144, at 148-49.
163 17 C.F.R. § 230.415(a)(4) (1985), reprinted in 1 Fed. Sec. L. Rep. (CCH) ¶ 3383. The rule requires an issuer to use an underwriter as an intermediary in an "at the market" offering. Id. § 230.415(a)(4)(iii). The underwriter, however, is more likely to fulfill a verification role rather than to distribute securities. See also Banoff, supra note 144, at 146-48 (discussing other possible innovative distribution techniques).
164 See note 161 supra for elaboration. The rule also limits shelf registrations of a company's voting stock to a maximum of 10% of the company's voting stock's public float (i.e., 10% of the aggregate market value of the outstanding voting stock held by nonaffiliates). 17 C.F.R. § 230.415(a)(4)(ii) (1985). This may minimize significant shifts in corporate control, the impact of which are presumably more slowly assimilated.
information? 165

If market efficiency is an important value in the distribution of securities, the best available evidence suggests it would have been prudent for the SEC to require a "cooling off" period between announcement and distribution of "at the market" equity offerings of perhaps one or two days. 166 At the very least the SEC should have continued the distribution technique as a temporary measure, subject to further tests of the market efficiency of such offerings. During the eighteen-month period in which Rule 415 operated experimentally, only a tiny handful of equity offerings were shelf-registrations listing "at the market distribution" as a possible technique (less than one percent of 7700 equity registration statements filed during the period). 167 This is too small a sample from which to draw conclusions about a technique that will probably become more prevalent. We hope that investigators will consider the market efficiency question despite the SEC's final adoption of Rule 415. 168

165 Note how the arguments about the two distribution techniques conform to our intuitions about who will engage in securities research. There is more concern about market efficiency in an "at the market offering" because smaller market participants are likely to be among the purchasers. For these smaller participants, it may be rational to rely on the prevailing price rather than investing in research. See note 81 and accompanying text supra. Presumably a company could also offer shelf-registered securities through a more conventional syndicated underwriting. The time between announcement of such plans and the actual sale would mitigate the market efficiency questions raised in the text.

In response to these market efficiency concerns one might question why purchasers from a shelf-offering should be better shielded from price uncertainty than trading market participants. See text accompanying note 162 supra. This might be answered by recognizing the greater vulnerability of primary purchasers due to greater profits to the underwriters in these transactions as compared to a brokerage transaction. See note 140 supra. One could also attempt to determine whether efficiency gains to companies from pinpoint timing of securities issuances outweighed such costs, the distributional consequences among shareholder groups, or ways of forcing companies to internalize such costs. Also to be considered in this regard is the extent to which shelf-registered offerings eliminate the observed underpricing of new issuances, see Banoff, supra note 144, at 153.

166 The SEC's original proposal would have permitted shelf-registration for companies required to use Form S-1 or Form S-2, as well as Form S-3. Release No. 6276, supra note 152. This would have been inconsistent with the assumptions of relative market efficiency underlying the three-tiered system. The SEC seems gradually to have realized this during the evolution of Rule 415. The temporary rule also limited "at the market" shelf-registered offerings to issuances registered on Form S-3. Release No. 6383, supra note 119, 47 Fed. Reg. at 11,397, Fed. Sec. L. Rep. at 83. The final rule limited shelf-registration to primary offerings of securities qualified to be registered on Form S-3 and to traditional shelf offerings (such as securities issued for dividend or interest reinvestment plans, employee benefit plans, or upon the exercise of various rights, including conversion). Release No. 6499, supra note 141, 48 Fed. Reg. at 52,894, Fed. Sec. L. Rep. at 86,342-43.


168 Critics also object that shelf-registration reduces the quality of disclosure because the absence of advance notification for an offering eliminates time for underwriter due diligence. See, e.g., Release No. 6423, supra note 152, 47 Fed. Reg. at 39,806-07, Fed. Sec. L. Rep. at 83,284-88 (Thomas, Comm'r, dissenting). The SEC's answer is that underwriters will engage in anticipatory and continuous due diligence. See text accompanying notes 140-43 supra. The
C. The Development of Corporate Law

Our discussion of the efficient market hypothesis and the finance theory paradigm challenges the basis of much recent legal scholarship on corporate law. This scholarship has argued that market forces can adequately resolve most of the principal-agent problems inherent in the split of ownership and control in large publicly held corporations. In an efficient market, the market prices of the firm’s securities will signal the relative quality of management because evidence of management shirking, misappropriation or incompetence will presumably be reflected in the firm’s securities prices. Two sets of markets use these signals: the market for corporate control, in which potential acquirors and proxy contestants seek to identify those companies where management has not maximized real economic returns; and the market in executive services, which evaluates managers’ ability to achieve superior results. The disciplining effects of these two markets, it is argued, render much of traditional fiduciary duty doctrine governing management conflicts of interest at best unnecessary and, not infrequently, counterproductive.169 Some adherents suggest that the only rules that can be justified are those that forbid management from attempting to impede the operation of these two markets, for example, through defensive tactics in (or anticipating) takeover bids or “golden parachute” management contracts.170

This reconceptualization of corporate law proposed by legal scholars depends upon a market that is both speculatively and allocatively efficient. This view implies that management efforts to resist a takeover bid at a premium over market are presumptively self-interested, and that corollary management assertions that the firm is undervalued by the stock market are not credible.

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169 See authorities cited in note 5 supra.

170 Such arguments about the need to protect marketplace mechanisms contain an inherent inconsistency. For example, some argue that “race to the bottom” style criticism of Delaware’s permissive corporate law ignores the disciplining effects of capital markets: if shareholders preferred more stringent corporate regimes, survival mechanisms would lead firms to incorporate in states providing such regimes. See Fischel, Race to the Bottom, supra note 5, at 916-20; Winter, supra note 5, at 275-76. This argument should also apply to attempts to impede market operation. That is, if shareholders value the unimpeded operation of the market for corporate control, why wouldn’t the same survival mechanisms lead firms away from tactics such as shark repellent amendments? Buried in such arguments is an unarticulated theory of marketplace failure. For a careful empirical consideration of the chartering competition claims, see Romano, Law as a Product: Some Pieces of the Incorporation Puzzle, 1 J.L. Econ. & Organization 225 (1985).
1. Marketplace Capitalization

This implication—that marketplace capitalization best reflects the value of the firm—is not required by, and may even be inconsistent with, the efficient market hypothesis and the associated finance paradigm. Modern portfolio theory generally, and CAPM specifically, model security prices in light of the risk a particular security contributes to a diversified portfolio of securities. Firm-specific risk can be isolated from systematic or market risk; the well-diversified portfolio can eliminate firm-specific risk. Modern portfolio theory claims that investors are not compensated for that risk that can be eliminated through diversification. Thus there is no basis for the assertion that prices prevailing in the stock market measure value of a firm to a potential acquiror. The acquiror of a firm will focus on firm-specific factors; the acquiror is not principally or even at all concerned with assembling an efficient portfolio. Moreover, CAPM’s assumption of uniform risk aversion among investors may not be tenable in the market for corporate control. Acquirors may not be risk averse, or risk averse to the same degree as ordinary investors, and thus may not demand the same premium for bearing identical risk. This could help explain why bidders’ prices are higher than market prices. In short, modern portfolio theory makes us aware that the market in shares generally and the market in all (or substantially all) of the shares of a specific firm may be very different markets.

Nothing about the efficient market hypothesis is inconsistent with this notion of two different markets.

2. Speculative and Allocative Efficiency

Our discussion of the efficient market hypothesis suggests that even if we accept the efficient market hypothesis and CAPM, there may be serious problems with legal scholars’ proposed reconceptualization of corporate law. Recall the two distinct senses of “efficiency” outlined

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171 See text accompanying note 43 supra.
172 See, e.g., R. Brealey & S. Myers, supra note 35, at 703-10 (comparing “sensible” motives for mergers, such as economies of scale, with “dubious” motives for mergers, such as diversification). The text may help to explain claims that the prevailing market price of a firm’s shares may not fully reflect the firm-specific potential synergy gains from a combination. See Leebron, Games Corporations Play: A Theory of Tender Offers, 61 N.Y.U. L. Rev. (forthcoming 1986).
173 Ordinarily the assumption of homogenous risk preferences among investors is not such a problem for CAPM, because one function of trade is to clear markets in light of different risk preferences. Compare Kanda & Levmore, The Appraisal Remedy and the Goals of Corporate Law, 32 UCLA L. Rev. 429, 437-41 (1985), discussing the theory of “inframarginality” in which investors may value their shares differently. Where the asset in question—control—is not readily divisible and trading is “lumpy” (a firm makes an acquisition or does not), the prevailing share price will not necessarily perform the clearing function.
above. Markets may be "speculatively efficient" in that prevailing securities prices are the best guide to financial returns. Markets may also be "allocatively efficient" in that such prices are the best guide to real economic returns. The proposed reconceptualization makes a strong claim for allocative efficiency: that prevailing securities prices will signal whether management is employing the firm's assets in the economically most productive way.

This claim relies on the efficient market hypothesis in two problematic ways. First, the extent of market efficiency now appears to be an open question. While the evidence does not suggest that securities research and trading will yield exceptional returns on major stock exchanges, the absence of a satisfactory asset pricing model to serve as a benchmark for normal returns leaves the extent of efficiency indeterminate. What level of efficiency is necessary before we would trust market mechanisms to do all the work of fiduciary duty doctrines? What markets (or market segments) will exhibit such efficiency? These unanswered questions undermine the evidence marshaled for the view that unfriendly tender offers, by displacing entrenched inefficient managements, increase shareholder welfare. The latest CAPM-based empirical work suggests that the existence of welfare gains, as measured by the

174 See text accompanying notes 10-15 supra.
175 See text accompanying notes 66, 94 supra.
176 Virtually all of the tests purporting to demonstrate increases in shareholder welfare study "abnormal returns" in stock prices of targets and acquirors before and after transactions to measure their economic effect. An essential element of such event studies is a benchmark of normal returns, provided in most studies by CAPM or a CAPM-variant. See Jensen & Ruback, The Market for Corporate Control: The Scientific Evidence, 11 J. Fin. Econ. 5, 9 (1983); see also Appendix A at note 203 infra (explaining technique using CAPM). We discuss at notes 53-62 and accompanying text supra the empirical and theoretical problems with CAPM. A shift in asset pricing models may lead to very different conclusions about the extent to which target firms underperform in relation to the market as a whole (prior to the takeover bid) and the extent of shareholder gains from the transaction. For example, a recent study of stockholder gains from mergers using a revised asset pricing model with an industry performance factor (in addition to the customary market performance factor) showed no comparative underperformance and much smaller shareholder gains than in CAPM studies. Langetieg, supra note 54, at 381-82.

To take another example for which there are as yet no tests: the widely noted small firm effect, in which portfolios of small capitalization companies seem to outperform portfolios of large capitalization companies. See, e.g., Banz, The Relationship Between Return and Market Value of Common Stocks, 9 J. Fin. Econ. 3 (1981); Reinganum, supra note 55; Schwert, supra note 55 (survey and introduction to symposium). The effect is of such magnitude and duration that it seems more likely to show CAPM misspecification rather than market inefficiency. But this particular misspecification problem may have particular impact on the analysis of merger gains, because many targets are smaller companies.

It should be noted that to say CAPM is misspecified is different from saying that the stock market inefficiently prices an industry sector or a specific group of companies (such as small companies). Compare Coffee, supra note 5, at 1211, 1226 (suggesting that market has "undervalued" stocks in particular industries and smaller companies).
combined gains to bidders and acquired firms, is a much closer question than previously thought. As a result, the accuracy of CAPM becomes an important problem.

Second, and more serious, the efficient market hypothesis does not on its own terms make an allocative efficiency claim; it claims only speculative efficiency. Recall the expected returns models of securities prices used to develop and test the efficient market hypothesis: price at some future time equals today's price plus anticipated returns from dividends, interest, and capital gains or losses during the holding period. Although dividends and interest are linked to real economic outputs in that a company must generate profits to make such payouts, there is no necessary connection between changes in security prices and economic outputs. The efficient market hypothesis posits only that prevailing prices are the best guess (minimum variance) of future prices, so that an investor cannot systematically outperform the market. The hypothesis does not explain when prices will change. Thus, contrary to suggestions in the legal literature, there is no inconsistency between the efficient market hypothesis and the Keynesian view likening investment management to the prediction of which photograph others will choose as the prettiest. In an efficient market, perhaps no one (not even Keynes) can outguess the market's assessment of which stock will be judged to be the prettiest, but that is a claim about speculative efficiency only, not allocative efficiency. 

The summary provided by Jensen & Ruback, supra note 176, at 11, of recent studies shows a range of gains in share prices for target shareholders from approximately 17% to 34% and for acquiror shareholders from approximately 2% to 7% (in successful takeover bids). These percentages may be misleading as to economic effect, however, because acquirors tend to be larger than targets, id. at 20. It is not clear whether a correctly specified asset pricing model would show such gains. See Malatesta, The Wealth Effects of Merger Activities and the Objective Function of Merging Firms, 11 J. Fin. Econ. 155 (1983).

See notes 25-26 and accompanying text supra. 

E.g., V. Brudney & M. Chirelstein, Cases and Materials on Corporate Finance 1191 (2d ed. 1979); R. Pozen, supra note 6, at 155.


The distinction between speculative and allocative efficiency reopens the question whether to limit the research in which institutional investors may engage. See text accompanying note 108-10 supra. Should we forbid research aimed at divining "market psychology?" Is there any reason to favor fundamental research instead? Some may want to limit institutional research to promoting allocative efficiency only, which rapidly becomes a claim for a focus on long-term rather than short-term performance objectives. But from a beneficiary-interest perspective, it may well be that the most successful long-term performance is one that maximizes short-term gains; the short-term player is not necessarily foregoing opportunities for greater long-term gains. Why penalize institutional investor beneficiaries? Moreover, short-term changes may be important signals in decisions bearing on economic outputs (such as whether to build a new plant).
In discussing the efficient market hypothesis, the legal literature has more or less assumed that allocative and speculative efficiency are identical. Such an assumption may seem surprising in light of historical and contemporary fads and bubbles in stock prices. One might ask whether such occasional demonstrations of strong allocative inefficiency suggest that significant allocative inefficiency is pervasive. Nevertheless, the efficient markets literature has assimilated two analytically distinct notions in assuming that a demonstration of speculative efficiency also shows allocative efficiency. Only recently has the link between allocative and speculative efficiency been subjected to empirical testing of the linkage between stock price movements and changes in real economic outputs. Some of these tests reject the hypothesis of allocatively efficient markets, while others have criticized the validity of the new tests. Despite the controversial status of the claim of empirical evidence of allocative inefficiency, its importance for legal policy warrants a discussion of its underpinnings.

The allocative efficiency paradigm asserts that real stock prices

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Mankiw, Romer and Shapiro present a new test of Shiller's claim that stock price volatility is too great relative to dividends for markets to be allocatively efficient. Their study supports Shiller's position, although its results are less dramatic.

An earlier draft of this Article gave more weight to Shiller's findings than we now offer because the research that questioned its methodology had not yet been published. The history of this Article therefore illustrates one of its major themes: legal policy makers must be wary of definitive statements in a rapidly changing, controversial area of economic research.
equal the present value of rationally expected or optimally forecasted future real dividends.\textsuperscript{184} Stock price movements are attributable to "new information" about future dividends. Thus stock prices, and changes in stock prices, will serve as the most reliable signals directing real economic investment. In a series of papers published in 1979 and later, Shiller and others have challenged the allocative efficiency paradigm.\textsuperscript{185} The basic work has consisted of comparing actual stock prices, as represented by broad-based market indices, against "perfect forecast" stock prices, which are comparable indices of constructed prices that should have been obtained if the actual future path of dividends had been known. The comparisons, whose statistical validity has been questioned, suggest that stock price movements are too great relative to actual subsequent events to be accounted for by reaction to new information about future dividends.\textsuperscript{186}

Several explanations for this discrepancy have been offered. One argument is that "stock prices are heavily influenced by fads or waves of optimistic or pessimistic 'market psychology.'"\textsuperscript{187} Alternatively, it has been suggested that information regarding significant changes in real dis-

\textsuperscript{184} Shiller I, supra note 183, at 424-28.
\textsuperscript{185} See note 183 supra.
\textsuperscript{186} "Perfect forecast prices" may be thought of as follows: Assume that the allocative efficiency paradigm is accurate and prevailing prices are the present value of anticipated future dividends. Then, for a particular past period, we can construct the right price for a particular security in light of actual dividend information. We can then compare changes in actual prices against changes in perfect forecast prices to determine if the observed price changes could have been triggered solely by new information leading to a revised forecast of future dividends. The finding of Shiller and others is that the magnitude of observed price changes is too large to be accounted for by reaction to new information.

These volatility studies can be more technically understood in light of previous discussion about the way in which EMH tests are "joint" tests of the hypothesis and the underlying asset pricing model. Volatility studies are EMH tests using a very simple asset pricing model linking the security price directly to the value of the real investment. Thus, for instance, the appropriate price of a stock is assumed to be the discounted sum of its expected dividend payouts. Consequently, the variance in dividends should exceed the variance in price of the security because the stock price is a weighted average of the expected dividends and moving averages display less dispersion than the series from which they derive.

Significantly, several volatility studies have shown that the prices of various securities are too volatile given the volatility of the underlying series. But see note 183 supra (discussing criticisms of studies). In addition to work discussed in the text, LeRoy & Porter, supra note 183, at 568-71, showed that stock prices were more volatile than the underlying earnings data, while Shiller III, supra note 183, showed that bond prices exhibited more volatility than their underlying yields. These and related tests reject the joint hypothesis of market efficiency and the particular asset pricing model.

Rejection of this asset pricing model is significant because it questions the link between speculative and allocative efficiency. Ideally, we would like financial markets to reflect the real returns underlying the security. The present value pricing models used in volatility studies make this link in the most direct manner.

\textsuperscript{187} Shiller II, supra note 183, at 294.
count rates may account for the volatility.\(^{188}\)

This controversy over the allocative efficiency of financial markets suggests caution in the use of stock prices, and stock price changes, as a simple measure of management performance.\(^{189}\) It may be inappropriate to rely upon stock-price based mechanisms to replace the fiduciary duty doctrine, because the market response to management overreaching, which would diminish dividends, or to management forebearance, which would increase them, is now controversial. Further, we may want to rethink rules that permit the unfettered operation of the market in corporate control if our primary justification is management discipline. The controversy over the allocative accuracy of stock price signals raises the possibility that the presumed benefits of an unregulated takeover market, the movement of assets into the hands of those who can maximize economic returns, may not exceed the costs of corporate takeovers.\(^{190}\)

**CONCLUSION**

Some readers of the early drafts of this Article questioned the importance of its observations about the relative failings of financial economics: that markets are at best “relatively” efficient in the speculative sense, thus at best “relatively” efficient in the allocative sense, and that CAPM provides at best a first order approximation of returns. Most of the legal policy assertions that derive from the modern finance paradigm, it is said, require only such relative claims. We have tried to demonstrate what may turn on the retreat to relativity. If markets are only relatively efficient, as we expect, then it is wrong to regard the search for undervalued securities by institutional investors as irrational behavior. If CAPM is at best a first order approximation, then investors lose a relatively simple prescription for optimal investing and a relatively easy means of measuring investment performance. Moreover, the degree of inaccuracy of

\(^{188}\) Grossman & Shiller, supra note 183. Another challenge to allocative efficiency is presented in Figlewski, Market “Efficiency” in a Market with Heterogeneous Information, 86 J. Pol. Econ. 581 (1978). Figlewski models market efficiency as a process in which traders with the best information (and skill) accumulate wealth at the expense of those with inferior information (and skill). He concludes that, although the market tends toward increased efficiency from this redistribution, it is unlikely to attain complete efficiency in either the short or long run. Id. at 596-97.

\(^{189}\) The lack of “fit” between perfect forecast price movements and actual stock price movements is demonstrated using market indices, rather than individual stocks, for greater generality of result. But the same disparity should obtain for individual stocks, insofar as indices are only aggregates of individual stocks.

\(^{190}\) The costs of takeovers are discussed by Coffee, supra note 5, at 1221-50, who warns of the takeover’s potential to promote inefficient transfers of control, adversely affect the labor market for executive services and employee performance generally, and foster undesirable risk-preference behavior by managers of both prospective targets and prospective bidders. See also Leebron, supra note 172.
CAPM severely calls into question the policy assertions in areas ranging from takeovers to mandatory disclosure, which rely on empirical assessment of changes in shareholder welfare (as measured through share price movements). Finally, if allocative efficiency tracks speculative efficiency only approximately (and that may be an optimistic account), then the usefulness of results from models based on share price changes may be radically limited.

In a sense our critics assume that the various models they employ are continuous functions: a result that holds where markets are efficient, for example, will approximately hold if markets are almost efficient.\footnote{Recent work in economics provides an example of an important discontinuity: a small amount of nonmaximizing (i.e., irrational) behavior may cause changes in the equilibrium of a system significantly larger than the losses to the nonmaximizers. E.g., Akerlof & Yellen, Can Small Deviations From Rationality Make Significant Differences to Economic Equilibria?, 75 Am. Econ. Rev. 708 (1985). “For some, it would be reassuring to find that the results of models based on maximizing behavior continue to hold as an approximation when the assumption of maximization is relaxed just slightly. It is, after all, difficult to believe that agents literally maximize all the time.” Id. at 708 (emphasis in original). The article goes on, however, to construct a number of examples that show that small deviations from rationality can have “first order” consequences, helping to explain, for example, business cycles and cartels. On the other hand, Akerlof and Yellen suggest that the effect of irrationality in markets can be dampened by rational arbitrageurs. Id. at 712. See also Haltiwanger & Waldman, Rational Expectations and the Limits of Rationality: An Analysis of Heterogeneity, 75 Am. Econ. Rev. 326 (1985) (in a market with “congestion effects,” sophisticated or maximizing agents will have a disproportionately large effect on the equilibrium). Russell & Thaler, The Relevance of Quasi-Rationality in Competitive Markets, 75 Am. Econ. Rev. 1071 (1985) (rational actors in financial markets can specialize in acquiring assets underpriced by quasi-rational actors).}

Unfortunately they work out no particular justification for this assumption in many areas of interest to legal policy makers.\footnote{For example, Gilson & Kraakman, supra note 5, appear to argue that relatively efficient markets will produce close to optimal results, so long as policy does not interfere with the mechanisms that produce efficiency. But the article seems to be uncertain about which version of relative efficiency it is prepared to embrace. At one point it suggests that the appropriate measure of relative efficiency is “the speed with which new information is reflected in price,” id. at 560, a view that suggests, first, that eventually the market becomes efficient (perfectly revealing) and, second, that the costs of inefficiency reside in the trades made during the adjustment period. At another point the article appears to embrace the Grossman-Stiglitz model, in which the measure of efficiency is quite different: the return to investment in information, see text accompanying note 82 supra, Gilson & Kraakman, supra note 5, at 578. In the Grossman-Stiglitz model, the market is never efficient; there is “an equilibrium degree of disequilibrium.” Grossman & Stiglitz, supra note 8, at 393. The cost of inefficiency resides in all market trades. The ultimate implications of these two views are quite different.}

One particular example illustrates the problems in assuming that nothing changes if markets are almost efficient. In a recent article, Easterbrook and Fischel present an argument for an unequal gain-sharing rule in corporate control transactions.\footnote{Easterbrook & Fischel, Corporate Control Transactions, supra note 5, at 700-15.} They argue first that unequal sharing makes gains-producing transactions more likely and then that even a risk-averse in-
vestor would prefer a rule that permitted unequal sharing because of the
opportunity to diversify against such firm-specific events. That is,
with a properly diversified portfolio, a shareholder is likely to be “on the
winning side of some transactions and the losing side of others,” and if
the effect of the rule is to promote gains, the expected return on the port-
folio will be higher. Thus, they claim that rational shareholders will
unanimously agree in advance to an unequal gain-sharing rule and that
fiduciary duty doctrine should sustain the hypothetical shareholder
bargain.

The problem with this argument is that it assumes full market effi-
ciency, not relative efficiency. If markets are only relatively efficient,
then some shareholders will derive gains from searching for undervalued
securities. It will thus not be irrational for them to fail to hold a diversi-
fied portfolio. Moreover, even fully diversified shareholders would bene-
fit from their search efforts, which help ensure relative market efficiency
and thus greater returns from a diversification strategy. The point is
that there would be no shareholder agreement on the unequal sharing
rule: searching shareholders would not agree because they do not hold
diversified portfolios and nonsearching shareholders would probably not
agree because they derive significant benefit from the efforts of the
searching shareholders. (Indeed, one might conjecture that the hypo-

194 Id. at 705-14.
195 Id. at 712.
196 Id. at 700-03, 711-14.
197 See note 79 supra and text accompanying notes 99-100 supra.
198 Nonsearching shareholders could conceivably decide that the gains from transactions
facilitated by an unequal sharing rule would outweigh the gains from increased market effi-
ciency resulting from the activity of searching shareholders. It seems unlikely that such share-
holders, by hypothesis diversifying because risk averse, would jeopardize a degree of market
efficiency that served their global objectives in exchange for unpredictable extra gains.

In defining the content of fiduciary duties, Easterbrook and Fischel slip between a descript-
tive account and a normative account, at one point referring to “the bargain that investors and
agents would strike if they were able to dicker at no cost,” Easterbrook & Fischel, Corporate
Control Transactions, supra note 5, at 702, and at another point stating that it is “[t]he exist-
ence of diversification—not its employment—that supports our argument,” id. at 713; they
then use the normative argument to dismiss implicitly the objection, see note 53 supra, that
many investors do not in fact diversify. But if markets are only relatively efficient, the hypo-
thesical unequal gain sharing agreement makes no sense on either account.

There are other objections to the Easterbrook and Fischel argument. Their assumption of
diversifiability, for example, is problematic, in that investors cannot be on the “winning” side
of going private transactions, or transactions generally in which the surviving party is a private
company. Moreover, the portfolio theory argument proves too much. Easterbrook and
Fischel would limit their unequal sharing rule to instances in which there is a gain (measured
against market value) and thus would exclude looting transactions, for example, from the
rule’s operation. Easterbrook & Fischel, Corporate Control Transactions, supra note 5, at
714-15. But if the looting is by a public company, the properly diversified investor is as likely
to win as lose. Additionally, as the text argues, there is no necessary magic in “market value”
(by which we assume is meant “market price”) for measuring gains. Moreover, on many occa-
theoretical shareholder bargain would be for an equal sharing rule on this account.) The lack of agreement follows from the relative efficiency of markets.199

In the best of all possible worlds, with allocatively and speculatively efficient markets, true theories dictate unambiguous legal policies. In our world, which may be only "close" to the best of all possible worlds, the insights provided by theories of financial markets require patient cultivation before legal policy flowers.

sions of unequal gain sharing, actions by a controlling shareholder may well depress the market price. See Brudney, Equal Treatment of Shareholders in Corporate Distributions and Reorganizations, 71 Calif. L. Rev. 1072, 1083-87 (1983); but see DeAngelo, DeAngelo & Rice, Going Private: Minority Freezeouts and Stockholder Wealth, 27 J.L. & Econ. 367 (1984) (analyzing 72 going-private transactions announced between 1973 and 1980 and finding that minority stockholders received gains comparable to those characteristic of interfirm mergers). For additional objections, see Coffee, supra note 5, at 1216-21.

199 The Easterbrook and Fischel argument derives directly from certain unanimity theorems in the finance literature. Easterbrook & Fischel, Corporate Control Transactions, supra note 5, at 714 n.34. These theorems refer to hypothetical value-maximizing agreements among shareholders about the production and financial decisions of the firm, on the assumption, inter alia, of the "spanning" of investment space, i.e., the existence of "complete" markets in which a security exists for every risk state. E.g., DeAngelo, Competition and Unanimity, 71 Am. Econ. Rev. 18 (1981). While in some instances spanning is not necessary for unanimity, see, e.g., Makowski & Pepall, Easy Proofs of Unanimity and Optimality Without Spanning: A Pedagogical Note, 40 J. Fin. 1245 (1985), spanning is necessary to guarantee unanimity if short sales are permitted. Makowski, Competition and Unanimity Revisited, 73 Am. Econ. Rev. 329 (1983). Our current markets permit short sales. Our objection on the ground of relative efficiency reduces, in terms of this literature, to a claim of incomplete markets, in that the searching investor (and perhaps the nonsearching investor) cannot lay off the risk of an unequal gain-sharing rule. We offer this suggestion with some hesitation. Unanimity theorems are complicated in their own right. No one appears to have pursued the linkage to efficient market theories and asset pricing models, in particular, when markets are "relatively" complete, "relatively efficient" and their prices "relatively" well-modeled.
APPENDIX A: A REVIEW OF EVIDENCE ON EMH

In this Appendix we present some of the evidence that supports and some that contradicts the efficient market hypothesis. As noted in the text, these studies jointly test the efficient market hypothesis and a corresponding asset pricing model. Most of the important empirical studies employ the capital asset pricing model.

I

TESTS USING CAPM THAT CONFIRM THE EFFICIENT MARKET HYPOTHESIS

A. Public Announcement Tests

Public announcement tests directly examine one important aspect of market efficiency: how rapidly the market digests new information. One of the most important tests confirming the validity of the EMH is a "public announcement" study conducted by Fama, Fisher, Jensen, and Roll ("FFJR"). The FFJR study examines the speed with which stock prices adjust to announcements of stock splits. The effect of stock splits on stock prices is a good illustration of the actual translation of information into price by the market: it can be observed dissociated from contemporaneous effects on other stocks in the market, because stock splits are company-specific events relatively isolated from general market movements.

The FFJR study used a market equilibrium model equivalent in all relevant respects to CAPM and a data set consisting of sequences of

\[ E(r_i) = \alpha_i + \beta_i E(r_M) \]

where \( E \) is an expected value operator, which is used to determine the expected value of a distribution; \( r_i \) is the one-period percentage return on asset \( i \); \( \alpha_i \) is a constant for asset \( i \); \( r_M \) is the one-period percentage return on the market index of all risky assets; \( \beta_i \) is a measure of the volatility of asset \( i \) relative to the market index, and the tildes (\( \sim \)) indicate that \( r_i \) and \( r_M \) are random variables; see note 25 supra.

The CAPM equation differs from the "market model" developed above principally because it includes an additional parameter, the risk-free rate of return, \( r_f \). (Thus the FFJR model is referred to in the literature as a "one parameter" model and CAPM as a "two parameter" model.) Conceptually this difference is very significant: while the FFJR model describes the rate of return as a statistical relationship among sets of returns, CAPM gives substantive content to that relationship in describing returns as the sum of a risk-free rate and a risk premium. For testing purposes, however, the equations are effectively very similar, because
prices for virtually all of the New York Stock Exchange stocks that split between 1927 and 1959. For each stock split, FFJR examined the price behavior of the stock over a period extending from approximately thirty months before to thirty months after the split month. For every month throughout the period, they calculated the difference of each stock's actual return from the return expected in light of the stock's usual relationship (its beta) with market returns. This difference is referred to as the "residual." To avoid the influence of factors unique to any one

they both characterize returns on securities in terms of the same linear relationship (having a slope of beta) with returns on the market portfolio.

The number of splits studied was 940. The only splits during this period not included in the data set were those that had a split ratio of less than five-to-four or that were by issuers that had been listed for less than twelve months.

The FFJR study, like most EMH tests, investigates whether particular analyses of information sets can generate "abnormal residuals," which can then be translated into trading profits. Thus, the FFJR market model (or CAPM) equation must be transformed into an expression suitable for regression analysis to be used in a test of the efficient market hypothesis. Moreover, for testing purposes, the model as stated must be modified, because it defines a relation only in terms of expectations, while generally we can observe only realized returns, not expected returns. See note 49 supra. This modification is easily effected by assuming that the realized return on a specific security can be determined by the sum of market model parameters and a random fluctuation (residual) with an average value of zero. After incorporating these changes, we may restate the previous equation as a testable one:

\[ \hat{r}_i = \alpha_i + \beta_i \hat{r}_M + \hat{e}_i, \]

where \( \hat{e}_i \) is a measure of the deviation of \( r_i \) from its conditional expected value, \( E(\hat{r}_i) \).

To restate the modified model more specifically, the return on security \( i \) during a particular period equals the sum of (1) a constant, \( \alpha_i \), (2) the product of a constant, \( \beta_i \), and the period's return on the market index, \( \hat{r}_M \), and (3) a disturbance term, \( \hat{e}_i \), which reflects the difference—or "residual"—between this particular period's realized return for security \( i \) and the expected value (based on all previously available information) of the return. In an efficient market, the expected value of the disturbance term, or "cumulative average residual," \( E(\hat{e}_i) \), is zero. Consequently, tests of the efficient market hypothesis generally focus on the extent to which these cumulative average residuals (CARs) deviate from zero.

A test of the efficient market hypothesis such as FFJR's would operate in the following manner: in the absence of new information, returns on a security will remain constant vis-à-vis the market (i.e., the observed disturbance term will on average equal zero). This serves as the test baseline. As new information regarding the security becomes available, we would expect a price change reflected by nonzero CARs. An efficient market quickly and completely digests such information, then incorporates it into the security's market price so that CARs for the security in subsequent periods equal zero. Similarly, the persistence of nonzero CARs (after correcting for other new information events) suggests market inefficiency.

With the framework of the EMH tests thus presented, it is possible to see how problems in the FFJR market model, or CAPM, might invalidate such tests that rely upon them. For example, as Roll argues, see text accompanying notes 60-64 supra, if the proxy selected for "M," the market index of all risky assets, were incorrect, then the residuals calculated on the basis of that value would consequently also be incorrect. The correct market index (or a better, or a different proxy) could provide a very different pattern of CARs and thus very different conclusions about market efficiency.

Perhaps, however, if the error in the market index proxy were totally uncorrelated with the phenomenon under study, then, on average, the CARs would be unaffected. See Roll, A Reply to Mayers & Rice, 7 J. Fin. Econ. 391, 395-96 (1979). But we cannot be certain of the lack of such correlation. For example, economic circumstances at particular times might lead
security, FFJR focused on average residuals—i.e., they determined the average residual for all observed splits for a given month before or after the split month. The hypothesis of the study was that because stock splits merely reslice the corporate pie into smaller pieces without any wealth transfer among shareholders, any associated change in adjusted stock prices was the result of a more fundamental corporate action signaled by the split, such as a future dividend increase.204

The study showed a pattern of increasingly positive average residuals over time until the split announcement month, followed by a distribu-

investors to expand or narrow their investment opportunities, thus affecting the market index and the relation between the index and the particular proxy used in the test. Such factors may be critical to the claims of some tests. See, e.g., Watts, Systematic 'Abnormal' Returns After Quarterly Earnings Announcements, 6 J. Fin. Econ. 127 (1978) (examining the period from 1962 through 1968, finding inefficiency during 1962 through 1965).

Misspecification errors, such as the omission of important elements in the returns-generating process, will also affect the calculation of CARs. Indeed, those who try to explain anomalous evidence regarding market efficiency frequently claim that such evidence only shows where CAPM has incorrectly modeled the returns-generating process. See, e.g., Ball, Anomalies in Relationships Between Securities' Yields and Yield-Surrogates, 6 J. Fin. Econ. 103 (1978). For example, one frequently hears the claim that the market “undervalues” small firms, as demonstrated by positive CARs for investment strategies that focus on such firms. See, e.g., Coffee, supra note 5, at 1226 & n.247. But the “small firm effect” may only demonstrate that CAPM omits important variables, such as market capitalization, asset ratios, and differential bankruptcy risk. More to the point, the small firm problem is directly correlated with a phenomenon frequently under study in CAPM-based tests, the evaluation of merger gains. See notes 55, 176 and text accompanying notes 53-59, 175-77 supra.

204 Some claim that the value of the firm, and thus its stock price, should not be related to dividend payouts, at least in perfect capital markets. See Miller & Modigliani, Dividend Policy, Growth and the Valuation of Shares, 34 J. Bus. 411 (1961); but cf. Litzenberger & Ramaswamy, The Effects of Dividends on Common Stock Prices: Tax Effects or Information Effects, 37 J. Fin. 429 (1982) (positive but non-linear correlation between dividend yields and stock prices). Some evidence suggests that changes in dividends do affect stock prices, which is attributable to information effects associated with management's signaling of future prospects. See, e.g., Aharony & Swary, Quarterly Dividend and Earnings Announcements and Stockholders' Returns: An Empirical Analysis, 35 J. Fin. 1 (1980); Woolridge, The Information Content of Dividend Changes, 5 J. Fin. Research 237 (1982).

It is commonly claimed that reducing the share price tends to increase the market liquidity of a company's stock and thus creates additional value. This seems highly unlikely as a general proposition for issues that trade in well-developed national markets such as the NYSE.
tion of average residuals around zero. This distribution around zero resulted even though most of the split firms experienced a dividend increase, suggesting that "the market apparently makes unbiased forecasts of the implications of a split for future dividends, and these forecasts are fully reflected in the price of the security by the end of the split month." Stated differently, in an inefficient market, the effects of the stock split would have been sustained over a longer period; accordingly, post-split average residuals would have been strongly positive and investors would be able to use a stock-split as a basis for predicting future prices.

Various studies in the late 1960's and early 1970's used the methodology of the FFJR study in tests of other public announcements. These tests were generally perceived as supporting the efficient market hypothesis.

205 E. Fama, supra note 19, at 156 (reproducing graphs for FFJR, supra note 100).

206 Id. at 163.

207 See E. Fama, supra note 19, at 165 (citing studies); Fama, supra note 1, at 408-09 (same). Other studies using the technique of analyzing "residuals" derived from market models, particularly CAPM, are canvassed in R. Brealey, An Introduction to Risk and Return from Common Stocks ch. 2 (1983). For a summary of evidence on the efficiency of European capital markets, see G. Hawawini, European Equity Markets: Price Behavior and Efficiency (1984).
B. Mutual Fund Tests

The development of CAPM also permitted other types of tests of the efficient market hypothesis. For present purposes, the most noteworthy of these scrutinized the performance of mutual funds.\textsuperscript{208} Such mutual fund tests have been particularly important in the effort to draw legal policy implications from efficient market theory.

Recall that market efficiency is determined relative to a specific information set. For efficient market theorists this limitation in the method of measuring market efficiency presents three problems. First, only a few of the many readily identifiable information sets lend themselves to easy statistical tests for market efficiency. For example, in an ideal situation one would want to test every type of company public announcement, but only a few types of announcements are sufficiently comparable from company to company to permit the necessary statistical analysis. Many important announcements—of an oil strike, an important contract, or a new product—are company-specific; thus their impact on the market can vary significantly. In such circumstances, aggregation and averaging techniques are methodologically inappropriate.

Second, and related, much important information is privately produced and can be neither identified nor sufficiently defined for market efficiency tests. For example, institutional investors analyze market, sectoral, and company-specific data. This processing of data creates new information—securities analysis—that the market may or may not efficiently absorb.

Third, the argument of efficient market theorists extends beyond their contention that the market is efficient with respect to specific information sets available to it. They also claim that all relevant information is in fact available to the market. Thus tests of efficiency relative to specific information sets can show only that the market reflects that specific information; such tests can never prove the more general claim that the market price reflects all relevant information.

Mutual fund performance tests avoid all of these problems. Assuming that sophisticated institutional investors such as mutual funds will acquire virtually all publicly announced information relating to a company's prospects, we can indirectly test market efficiency for all such information sets by testing whether mutual funds outperform the market. Similarly, tests of mutual fund performance should show whether the market is efficient with respect to sets of privately produced information that mutual funds produce or acquire. Finally, assuming that the vast

amounts of assets at risk lead mutual funds to seek out all relevant information, mutual fund tests address EMH theorists' general claim as well.\textsuperscript{209}

The CAPM tests of mutual funds performance sought to evaluate risk-adjusted performance.\textsuperscript{210} Jensen's CAPM study, the most widely cited test, examined mutual fund performance over the ten-year period from 1955 through 1964.\textsuperscript{211} It employed a research strategy designed to account for risk. First, for a several-year period the test determined the risk of a fund's portfolio\textsuperscript{212} and its return. Second, it compared this return to the return on a hypothetical portfolio consisting of the market portfolio (for which the Standard & Poor's 500 is used as a proxy) combined with the risk-free asset, in proportions necessary to achieve the same risk as the mutual fund.\textsuperscript{213} The tests showed that mutual fund performance, when ignoring advisory fees, commissions, and other expenses, was no better than that of a passive investor choosing a portfolio consisting of the market portfolio and risk-free assets.\textsuperscript{214}

This study provided a powerful affirmation of the efficient market hypothesis. Mutual funds cannot outperform the market on a risk-adjusted basis even assuming that they do not pay for securities research

\textsuperscript{209} The mutual fund tests thus embrace challenges to the "semi-strong" form of the efficient market hypothesis, which assumes the availability of all public information, and the "strong form," which assumes the availability of all relevant information including inside information. The two information sets are not obviously separable in performance testing of mutual funds. Superior performance could derive from keener insight or privileged access to corporate information. There is a substantial claim that the large amount of investment capital under the control of institutional investors gives them such access through the medium of security analysts.

\textsuperscript{210} Other studies of mutual fund performance relied on simple comparisons to market indices. E.g., I. Friend, M. Blume & J. Crockett, Mutual Funds and Other Institutional Investors (1970). Tests that ignore risk/return relationships may produce serious problems, however. For example, a very conservative fund that underperforms the market on absolute terms may nevertheless be a superior performer on a risk-adjusted basis. The converse may be true of a more speculative fund that outperforms the market.

\textsuperscript{211} Jensen, Mutual Funds, supra note 208.

\textsuperscript{212} The risk of a portfolio is the weighted average of the betas of portfolio stocks, i.e., their volatility relative to the market index.

\textsuperscript{213} Jensen's hypothetical portfolio is based on application of the Separation Theorem, explained in note 46 supra.

\textsuperscript{214} Jensen characterized performance in terms of the appropriate definition of "return." Where return is the measured net of loading charges, management fees, commissions, and other costs, Jensen found that over a ten-year period, returns for 89 of 115 funds were below the hypothetical CAPM efficient portfolio, and that average deviations were $-14.6\%$. Ignoring loading charges, 72 of 115 funds underperformed the hypothetical portfolio, with an average deviation of $-8.9\%$. Even disregarding all expenses, Jensen found that mutual fund performance was no better, on average, than that of the hypothetical portfolio. Approximately half the funds performed worse than, and half better than, the hypothetical portfolio. Moreover there was no significant correlation for superior performance from one period to the next.
and trading expenses. This implies that all the information employed by mutual funds in stock selection is already impounded in the market price.

There are several objections to these tests of mutual fund performance. First, in measuring performance against a CAPM efficient portfolio, the tests incorrectly assume the opportunity for mutual funds to leverage a market portfolio, that is, for mutual funds to pursue a strategy of greater-than-market risk in the optimal way. The SEC seriously limits direct borrowing by mutual funds or borrowing for margin purchases of stock.\footnote{Mutual funds cannot issue “senior securities,” such as debt securities, and can only borrow from a bank to the extent of a 300\% asset coverage for any such loan. Investment Company Act of 1940, \textsection 18(f)(1), 15 U.S.C. \textsection 80a-18(f)(1) (1982). The SEC has taken the position that margin borrowing from a broker-dealer would be a forbidden issuance of a “senior security.” Fed. Sec. L. Rep. (CCH) \textsection 51,208, at 39,173 (1983) (guidelines for Form N-1A, guides 7 & 10). See 3 T. Frankel, supra note 117, ch.XXI, B \textsection 11.2, at 289-91. This requires mutual funds to seek margin loans from banks, which are subject to a more stringent set of margin rules than broker-dealers, and subjects the funds to the 300\% asset coverage requirement. See generally 3 T. Frankel, supra note 117, ch. XXI, B \textsection\textsection 11.1-12.2, at 288-95.} Moreover, because the SEC requires disclosure of such borrowing as a special risk factor,\footnote{Fed. Sec. L. Rep. (CCH) \textsection 51,208, at 39,173, 39,178 (guidelines for Form N-1A, guides 4 & 21). See 3 T. Frankel, supra note 117, ch XXI, B \textsection 11.2, at 289-91.} the sponsoring investment advisor is likely to regard even such legally permissible borrowing as an impediment to marketing the fund.\footnote{See, e.g., Value Line Leveraged Growth Investors, Inc., Prospectus 1, 6 (April 30, 1982).} Thus it is not surprising that mutual funds seeking greater risk would underperform the CAPM efficient portfolio. To illustrate this point, examine the diagram at note 46 supra. A risk-seeking mutual fund would at best be at a point on the efficient portfolio frontier, not on the optimal capital market line above. Indeed, any evidence that such funds could systematically match the CAPM portfolio performance would cut against the efficient market hypothesis.

Jensen’s research is also criticized for methodological flaws that understate mutual fund rates of return and overstate levels of systematic risk.\footnote{Mains, Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios: Comment, 50 J. Bus. 371 (1977). Jensen’s work assumed that mutual fund systematic risk levels remained constant over time (i.e., that a given fund would have the same “beta” over the ten-year period) and that each fund incurred the same average operating and commission expenses. Mains showed that these assumptions were factually incorrect and led to understatement of mutual fund returns and overstatement of their risk levels.} Correcting for these flaws, the results are significantly different. On this view, mutual funds were approximately “neutral” performers on a net return basis. That is, taking into account all expenses, mutual fund performance equalled that of the passive investor; or, if expenses were ignored, most mutual funds earned significant abnormal returns.\footnote{Id. at 384.} This analysis obviously reverses Jensen’s conclusion that prevailing prices reflect all relevant information.
The text develops the most important objection to the mutual fund performance tests, the most serious one because it applies to all such tests: that CAPM itself may not adequately portray the risk-return relationship in a way that provides a reliable measure of normal returns.\textsuperscript{220} The objection is both empirically and theoretically based. If CAPM is seriously flawed, the mutual fund tests lose validity, and some of the strongest efficient market evidence loses its force.

II

TESTS USING CAPM THAT REJECT THE EFFICIENT MARKET HYPOTHESIS

As recently as 1976 a leading efficient market theorist could think of only one study that seriously questioned the efficient market hypothesis in its semi-strong form.\textsuperscript{221} The efficient market hypothesis was noteworthy for its strong empirical support and the "sparse" contradictory evidence.\textsuperscript{222} Recently, however, a number of careful studies have revealed significant lags in the stock market's reflection of public announcement information such as earnings, stock splits, and dividends, and have demonstrated the potential for profitable trading strategies based on these observations.\textsuperscript{223} These studies are thus inconsistent with market efficiency.\textsuperscript{224} Moreover, other recent studies have shown the potential for trading profits on the basis of analysts' forecasts.

A. Public Announcement Tests

Most public announcement tests study the impact of announce-

\textsuperscript{220} See text accompanying notes 53-65 supra.
\textsuperscript{221} See E. Fama, supra note 19, at 379 (citing Jaffe, Special Information and Insider Trading, 47 J. Bus. 410, 413 (1974) (significant abnormal returns from use of published SEC data on insider purchases and sales)).
\textsuperscript{222} Fama, supra note 1, at 416.
\textsuperscript{224} Observe the potency of public announcement tests questioning market efficiency. If the market is not efficient with regard to such widely disseminated data, how could it possibly be efficient with regard to other available information?
ments of firms' earnings on security prices. A recent survey discussed twenty separate studies questioning market efficiency in connection with earnings announcements. It concluded that securities appear to "yield systematic excess returns in post-announcement periods." This evidence suggests that the excess returns increase as the extent of any earnings "surprise" increases, and that such excess returns persist over time.

Two subsequent studies merit more detailed discussion. In a study of quarterly earnings announcements, Watts identified NYSE companies whose announced quarterly earnings deviated from their predicted earnings. He then tested whether stock prices adjusted quickly to this unexpected earnings information, as the efficient market hypothesis would predict. According to the study, market adjustment takes place over the two quarters (up to twenty-six weeks) following the earnings announcement. Because of transaction costs, individuals could not ordinarily benefit from this inefficiency, but brokers and those rearranging their portfolios for unrelated reasons (and thus incurring no marginal cost for trading) could earn abnormal returns. Watts concluded that his study did not show a "gross inefficiency" but did point to "a profit op-

225 Ball, supra note 59, at 118-24.
226 Id. at 103. After having rejected the possibility of systematic experimental error as an explanation for the anomalous returns, Ball hypothesized that the capital asset pricing model is misspecified. In particular, he suggested that the earnings and dividend variables examined in post-announcement studies "proxy" for missing variables in the CAPM. Id. at 110-11. See text accompanying note 59 supra.
227 Watts, Systematic Abnormal Returns after Quarterly Earnings Announcements, 6 J. Fin. Econ. 127 (1978). Watts's study is particularly important because it attempts to address some of the issues raised by Ball regarding experimental design and errors in CAPM.
228 Id. at 139. Watts generated quarterly earnings forecasts from three models that extrapolate from previously reported quarterly earnings. In order to adjust for risk in evaluating whether returns were abnormal, Watts used a technique that avoids some of the complexity inherent in differently specified versions of the CAPM.

For each quarter and each forecast model the firms under investigation are split into two portfolios: the firms with positive forecast errors for the quarter; and the firms with negative forecast errors. The weights applied to the securities within each portfolio are calculated to make the beta of each portfolio equal to unity. Since both portfolios have equal risk, abnormal returns can be measured as the difference in returns between the two portfolios.

Id. at 130. That is, abnormal returns are calculated on the assumption that the investor bought shares of companies with positive earnings forecast errors and sold short an equal dollar amount of the shares of companies with negative forecast errors.

The evidence showed that for all three forecasting models there were substantial abnormal returns in the quarter following the announcement of unexpected earnings. Id. at 145. This is not surprising; it indicates only that earnings announcements convey or reflect new information not previously anticipated by the market. These abnormalities persisted, id. at 146, however, through the second quarter following the announcement, which is not consistent with the efficient market hypothesis. (It is also true, however, that a large portion of the ultimate adjustment did occur in the quarter immediately preceding the announcement.)
portunity foregone, an inefficiency.”

Charest examined market reaction to stock split announcements for NYSE stocks during the period 1947 through 1967. The study in many respects replicates the influential Fama, Fisher, Jensen, and Roll study of NYSE stock split announcements from 1927 through 1959, but with a very different conclusion: the new study found that utilization of a relatively simple trading rule would produce significant excess returns for three months beyond the public announcement date. The discrepancy in the studies is accounted for by a difference that should be immaterial in an efficient market: FFJR used the announcement of the split realization as the relevant public announcement; Charest focused on the announcement of the split proposal, on the theory that stock-split proposals are seldom rejected by shareholders and that an efficient market should recognize this. Although the study found evidence of

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229 Id. at 142. Watts studied the period from 1962 through 1968. The observed market inefficiency occurred primarily during the September 1962 through October 1965 period. He speculated that the observation of inefficiency might have been by chance or that the market might have become more efficient after 1965. Id. at 146. A subsequent study of earnings announcements covering the period from 1963 through 1971 concluded that the market was not more efficient in later periods. Nichols & Brown, Assimilating Earnings and Split Information: Is the Capital Market Becoming More Efficient?, 9 J. Fin. Econ. 309, 311 (1981). The two studies are not entirely comparable. Whereas Watt used all cases of unexpected earnings from his random sample of firms, Nichols and Brown focused on “outliers,” instances where earnings increases were far greater than the median increase. A possible conclusion consistent with both studies is that the market became more efficient with respect to earnings announcements generally, but not for significant unexpected earnings. Id. at 311-12.


231 See text accompanying notes 200-06 supra. Charest used an equilibrium returns generating model of the form:

\[ r_t = \bar{r}_t + B(f_{t-M} - \bar{r}_0) + \varepsilon_t \]

following Black's respecification of the CAPM in terms of the rate of return on a minimum variance, or zero beta, portfolio \((r_0)\), rather than the risk-free rate of return \((r_f)\), as described at note 53 supra. Thus the return on a particular security in a given period is the sum of (1) the market's return on a zero beta portfolio, (2) the product of the security's beta, or systematic risk, and the return premium per unit of beta, and (3) a disturbance term of zero expected value. This model is an elaboration on the market model used by FFJR, and should not systematically bias results. See also notes 201 supra and 234 infra.

232 To determine whether average residuals and cumulative average residuals were statistically significant, Charest employed the following trading rule: after the relevant split announcement event, buy the stock, hold for \(x\) months, then sell. The result will be rolling portfolios of securities, each held for the same time span. The study found significant residuals where the event was the split proposal announcement and the holding period was three months. Id. at 266.

233 Of the 1,080 stock split proposals during the 1959 through 1965 period covered by the study, Charest selected every tenth case for follow-up investigation and found no rejections. Id. at 279.

234 The significance of the split proposal/realization distinction is underscored by other results in the Charest study that largely correlate with the split realization conclusions in FFJR. Charest did raise the possibility that the inefficiencies were attributable to other factors. He
excess returns, Charest cautioned that the observed inefficiency was not "acute," and raised questions whether transaction costs would erode any potential trading profits.\textsuperscript{235} Nevertheless, he regarded the evidence of inefficiency as significant.\textsuperscript{236}

Charest produced an important companion study that examined market reaction to announcements of significant cash dividend changes for NYSE stocks during 1968 through 1974.\textsuperscript{237} This study found that a relatively simple trading rule could generate significant abnormal returns for dividend-changing stocks for up to two years after the announcement of the increase or decrease in the dividend.\textsuperscript{238} The evidence of abnormal returns with respect to dividend decreases was so striking that Charest stated: "On the surface, it appears that the market is clearly inefficient

\textsuperscript{235} Id. at 284. Like Watt, Charest identified a specific subperiod, here 1956 through 1960, during which a significant proportion of the excess residuals accumulated. Nichols and Brown's study of market efficiency also examined the effects of stock splits on the market. See Nichols & Brown, supra note 229. The study found no evidence of market inefficiency during the 1960 through 1967 subperiod, agreeing with Charest, but did find evidence of market inefficiency in a later time period, 1968 through 1975. Id. at 314.

\textsuperscript{236} Charest, supra note 230, at 288.

\textsuperscript{237} Charest, Dividend Information, Stock Returns and Market Efficiency—II, 6 J. Fin. Econ. 297 (1978). The study considered relatively large changes (ten cents or more per share after two or more years of stable dividends) for seasoned NYSE stocks (listed at least five years) from January 1947 through June 1968, "a period of recognized stability in risk levels, tax laws, and inflation rate." Id. at 298. The selection criteria produced 1,193 dividend increases and 527 decreases. Id. at 300.

\textsuperscript{238} The equilibrium returns model used to determine excess returns, or "residuals," was the same model used in the Charest study on stock splits, see note 231 supra. Charest determined the average monthly residuals for the observed stock for a 49-month period. The period included the 24 months preceding and following the stock's dividend change announcement including the month of the announcement.

For dividend increase announcements, he noted that although the market "appears to react briskly to such announcements, it may not react enough, since we witness sizable post-announcement residuals." Id. at 306. The accumulated data revealed that during the dividend increase announcement month, the average residual was 3.18%. But subsequent cumulative average residuals amounted to 1.74% after 6 months following the month of the increase announcement, 2.19% after 12 months, 2.80% after 18 months, and 3.96% after 24 months. Id. at 305 (Table 4). Thus, if the period of market adjustment was 24 months, less than half of the adjustment occurred within one month of the announcement.

The results with respect to dividend decrease announcements were even more striking. During the dividend decrease announcement month, the average residual was -7.42%. Subsequent cumulative average residuals amounted to -4.13% after 6 months following the month of the decrease announcement, -5.49% after 12 months, -6.18% after 18 months, and -7.69% after 24 months. Id. at 307 (Table 5). Again using 24 months as the market adjustment period, less than half of the adjustment to a decrease announcement occurred within one month of the announcement, and the residual numbers were approximately twice as large as for increases.
with respect to dividend decrease information." This inefficiency led Charest to conclude that a "systematic trader in dividend changing stocks would have earned significant abnormal returns."

**B. Analysts' Forecasts Tests**

Recent studies of analysts' forecasts present important evidence inconsistent with the efficient market hypothesis. These studies evaluated the extent to which analysts' forecasts contain information not previously impounded in market price. A very important recent study by Dimson and Marsh directly addressed this issue. It compared actual analysts' forecasts for specific stocks made privately to an institutional investor over a yearlong period with realized returns, and concluded that the comparison revealed a small but potentially useful degree of forecasting ability. The study further concluded that such forecasts can be translated into actual trading profits: the particular investor used such forecasts to achieve significantly superior risk adjusted returns over a year (on the order of 1.7 percent after deducting all avoidable transaction costs). These conclusions are of course inconsistent with the efficient market hypothesis's claim that prices reflect all relevant information, and further undercut Jensen's claim that mutual funds cannot earn even a competitive return from investments in securities analysts' forecasts.

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239 Id. at 308.
240 Id. at 326. In order to determine whether the observed residuals indicated actual market inefficiency, Charest tested portfolio trading rules as he did in his stock-split study, see note 232 supra. His data indicated that trading following dividend increase announcements generated significant excess returns for holding periods of 2, 3, 4, and 5 months. Id. at 315. Trading following dividend decrease announcements generated even larger excess returns, for all holding periods considered (1 through 5 months). Excess returns ranged from 1.5% a month for a 1-month holding period strategy and 1% for a 2-month holding period strategy, to 0.25% for a 5-month holding period strategy. Id. at 311-14 (Tables 7, 8). Charest observed that given the average normal returns (of approximately 1.1% a month) earned by NYSE stocks in the 1947 through 1967 period, these excess returns were "rather impressive." Id. at 311. The practical results were that "(1) systematic buyers of dividend decreasing stocks would stand to lose significantly on their investments; (2) shortsellers would likely gain abnormally, and (3) portfolio managers would avoid non-negligible capital losses by jettisoning such stocks at the time of a dividend decrease." Id. at 311, 314. In contrast to his stock split study, Charest observed no subperiod of particular efficiency or inefficiency.

242 Id. at 1288. This conclusion was based on a study of more than 400 specific stock return forecasts made by 35 UK stockbrokers and the internal analysts of one large UK institutional investor. Id. at 1274.
243 Id. at 1274. This conclusion was based on an analysis of approximately 3000 transactions motivated by and executed at the time of the forecasts. Id. Accord Bjerring, Lakonishok & Vermaelen, Stock Prices and Financial Analysts' Recommendations, 38 J. Fin. 187 (1983) (investor following recommendations of Canadian brokerage house would have achieved significant positive abnormal returns after transaction costs).
Another set of analysts' forecast studies employed a different testing strategy. Instead of examining market reaction to public announcements of company information, these studies examined market reaction to the publication of analysts' forecasts. The evidence showed that investors having knowledge of analysts' forecasts (particularly revisions in forecasts) can make trading profits. Furthermore, market reaction to public disclosure of the forecasts is relatively slow, providing further opportunity for trading profits. These studies challenge the efficient market hypothesis in two ways. First, if analysts' forecasts can provide the basis for a profitable trading strategy, then it would seem that the information contained in them is not already impounded in the market price. This is, of course, inconsistent with the efficient market hypothesis's claim and suggests that mutual fund purchases of analysts' forecasts could be profitable. Second, the market's slowness in digesting analysts' forecasts after they are publicly announced strongly suggests market inefficiency. Prevailing prices in an efficient market should quickly reflect new publicly announced information known to affect price.

All of these studies are inconsistent in varying degree with the efficient market hypothesis. In particular, if the market is not demonstrably efficient in digesting public announcements and other information supplied to the market free of charge, how likely is it that the market will be efficient with respect to information costly to obtain or analyze? The studies thus represent serious challenges to the capital market theory of the past two decades, including the efficient market theory and the equilibrium return generating models used to test it.


245 Contemporaneous and subsequent studies of similar effects include Beaver & Landsman, Note on the Behavior of Residual Security Returns for Winner and Loser Portfolios, 3 J. Acct. & Econ. 233 (1981) (abnormal returns observed after earnings announcement in some years may relate to the securities tested rather than the announcement itself); Brown, Earnings Changes, Stock Prices, and Market Efficiency, 33 J. Fin. 17 (1978) (adjustment time to announcements of unusual earnings information for NYSE and AMEX stocks during the 1963 through 1971 period is sufficiently lengthy to permit trading profits); Latané & Jones, Standardized Unexpected Earnings—1971-77, 34 J. Fin. 717, 723-24 (1979) (market is more efficient for stocks closely followed by analysts than for others); Nichols & Brown, supra note 229 (market was somewhat inefficient from 1968-1975 and may not efficiently digest unexpected earnings changes); Reinganum, supra note 55 (market efficiency anomalies strongly suggest that CAPM is misspecified); Rendleman, Jones & Latané, Empirical Anomalies Based on Unexpected Earnings and the Importance of Risk Adjustments, 10 J. Fin. Econ. 269 (1982) (abnormal returns could have been earned during 1970's because of significant standardized unexpected earnings).
APPENDIX B: THE "RANDOM WALK" OF STOCK PRICE MOVEMENTS

The "random walk" hypothesis\(^{246}\) is based on an asset pricing model that makes a very restricted claim. The hypothesis asserts that the change in price from period \(t\) to period \(t + 1\) does not depend upon the price change from \(t - 1\) to \(t\); instead, each price change is drawn independently from some stable distribution.\(^{247}\)

What does the random walk hypothesis imply about the mechanism?

\(^{246}\) The random walk hypothesis originated from examinations of common stock price movements on the New York Stock Exchange, as did the efficient market hypothesis. Work in the late 1950's suggested that patterns of price changes were very similar to those produced by a random number generator. E.g., Osborne, Brownian Motion in the Stock Market, 7 Operations Research 145 (1959), reprinted in The Random Character of Stock Market Prices 100 (P. Cootner ed. 1964); Roberts, Stock-Market "Patterns" and Financial Analysis: Methodological Suggestions, 14 J. Fin. 1 (1959). Subsequent work in the 1960's led to formalization of these perceptions as the "random walk" hypothesis. See generally J. Lorie & M. Hamilton, supra note 36, at 70-97.

The random walk hypothesis leads to a "weak" form of the efficient market hypothesis, which posits that prevailing prices incorporate all information contained in the history of price movements. The "story" that accompanies the random walk, however, suggests much stronger forms of market efficiency: price changes are random because the market quickly and fully reflects all available information (because there were no patterns of correlation suggesting a period over which the market was "digesting" information). Further price movements come from the random appearance of new information, which by hypothesis had previously been unavailable.

\(^{247}\) It may be helpful to think of the random walk in these terms: Imagine an urn containing balls each inscribed with a number representing a possible price change. At each period \(t\), a ball is drawn from the urn and the security price changes by the amount specified on the ball. The ball is then replaced in the urn and the process repeated in the next period. The random walk process has two important properties. First, the price change from \(t - 1\) to \(t\) tells nothing about the prospective price change from \(t\) to \(t + 1\), because the composition of balls in the urn used to determine the price change at \(t\) does not depend in any way on the draw at \(t - 1\). This property is called statistical independence. Second, the composition of the urn—the distribution of possible price changes—remains unchanged from period to period, i.e., in every time period \(t\), the price change is drawn from the same urn and the ball is returned to the urn. Consequently, the probability of any given price change occurring (a number determined by the ratio of balls with a given price change to the total number of balls), is the same in each period. This property is called stationarity.

Stationarity is important to the efficient market hypothesis in two ways. First, the sophisticated asset pricing models used in important EMH tests rest on the assumption that the distribution of securities returns is stationary. This is necessary for the estimation of the key variables in the models, for example, "beta" in CAPM. See notes 44, 53, 74, 201 supra. Second, stationarity plays a significant role in one of the current formulations of the efficient market hypothesis. Most theorists interpret the efficient market hypothesis to include an assertion that investors have "rational expectations," i.e., that their estimates of the distribution of returns (from which they calculate expected returns and risks) accords with the true distribution. See note 49 supra. The requirement of rational expectations of individual investors is justified by a "learning process": if investors do not have rational expectations they frequently make erroneous predictions that they then attempt to correct. Supporters of rational expectations argue that if the distribution of returns was stationary, investors would eventually discover the true distribution and the underlying returns-generating process. If the distribution was not stationary, however, it would be difficult to learn the underlying process. It is worth noting that the possibility of learning the process even under stationarity is controversial. See

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of setting asset prices? First, it indicates that the price-setting mechanism will be a fair game. That is, on average, in a random walk process the price at $t + 1$ equals the price at period $t$ that people expect to prevail at $t + 1$. A roulette wheel with forty numbers that pays $40 for a winning bet of $1 is an example of a fair game. Second, if prices follow a random walk, the price change from $t - 1$ to $t$ will not affect the probability that a particular price change will occur at period $t + 1$. Early empirical evidence on stock price movements substantially confirmed this second implication.

These claims about asset pricing seem to be minimal, yet actual price movements do not entirely conform to the hypothesis. Large daily price changes appear to follow one another—although the signs of such changes are not correlated. On any given day price changes appear in successive patterns of continuation or reversal. The important ques-


248 This independence assumption does not imply that the history of prices says nothing about the process of price formation. One might know that the process was a random walk but not know from what distribution price changes were drawn. In that case, a good estimator of the distribution of price changes would be the history of past price changes. The longer the available history the better the estimator will be.

249 The early generations of high-speed computers in the 1960's allowed the rigorous testing of the random walk hypothesis. Among the most important tests were those that looked for serial correlation or covariance among stock prices over various “differencing intervals.” For instance, an investigator would choose some time lag over which he thought a price change might have an effect: say four time periods, as an example. He would then examine a series of prices and calculate the price changes. These price changes would then be paired with the price at four periods later, and the two sequences would be examined for any consistent pattern. If the two sequences moved together, i.e., were correlated or had nonzero covariance, one could improve a prediction of a future price from knowledge of the price change four periods before. Extensive testing found, however, no evidence of “substantial linear dependence between lagged price changes or returns.” Fama, supra note 1, at 394. See also J. Lorie & M. Hamilton, supra note 36, at 75-77 (discussing serial correlation tests).

The conclusion that prior price information did not allow prediction of future price changes made the random walk hypothesis highly controversial. On Wall Street, many security analysts, tagged “technical analysts,” sold predictions based on precisely this type of information. Moreover, the hypothesis contradicted earlier academic research that purported to find trends in stock price movements. E.g., Cowles & Jones, Some A Posteriori Probabilities in Stock Market Action, 5 Econometrica 280 (1937), withdrawn as erroneous, Cowles, A Revision of Previous Conclusions Regarding Stock Price Behavior, 28 Econometrica 909 (1960). See generally R. Hagin, The Dow Jones-Irwin Guide to Modern Portfolio Theory 15-28 (1979) (catalogues early research and more recent and rigorous testing of the random walk hypothesis concluding that no research has refuted the hypothesis, given a differencing interval of 1-16 days); Working, A Random-Difference Series for Use in the Analysis of Time Series, 29 J. Am. Statistical Ass'n 11 (1934). For recent studies challenging the weak form of efficient market hypothesis, and thus, the random walk claim, see note 223 supra.


251 See, e.g., Niederhoffer & Osborne, Market Making and Reversal on the Stock Exchange,
tion, however, is the significance of these apparent patterns. What does it matter if one can predict that the next price change will probably be large, if one cannot predict the direction? The realization that price movements are not totally random, but that dependencies can not be exploited by market participants to produce trading profits, led economists to search for another model of asset pricing: one that preserves the conclusion that knowledge of past prices does not allow investors to earn abnormal trading profits but that conforms to the evidence of non-randomness in price changes. This is the positive expected returns model discussed in the text.252

61 J. Am. Statistical Ass'n 897 (1966); see also Niederhoffer, A New Look at Clustering of Stock Prices, 39 J. Bus. 309 (1966) (noting traders' tendency to issue buy or sell orders when stocks reach a round number).

252 See text accompanying notes 23-29 supra.