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THE MECHANISMS OF MARKET EFFICIENCY*

*Ronald J. Gilson and Reinier H. Kraakman***

OF all recent developments in financial economics, the efficient capital market hypothesis ("ECMH") has achieved the widest acceptance by the legal culture. It now commonly informs the academic literature on a variety of topics;¹ it is addressed by major law school casebooks and textbooks on business law;² it structures

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¹ See, e.g., H. Kripke, *The SEC and Corporate Disclosure: Regulation in Search of a Purpose* 83-139 (1979) (disclosure under the federal securities laws); Barry, *The Economics of Outside Information and Rule 10b-5*, 129 U. Pa. L. Rev. 1307, 1330-59 (1981) (disclosure under the federal securities laws); Bines, *Modern Portfolio Theory and Investment Management Law: Refinement of Legal Doctrine*, 76 Colum. L. Rev. 722 (1976) (fiduciary duty of portfolio managers as trustees); Easterbrook & Fischel, *Corporate Control Transactions*, 91 Yale L.J. 698, 723-31, 729 & n.84 (1982) (freezeouts of minority shareholders); Fischel, *Efficient Capital Market Theory, the Market for Corporate Control, and the Regulation of Cash Tender Offers*, 57 Tex. L. Rev. 1 (1978) (regulation of tender offers); Lorie, *Insider Trading: Rule 10b-5, Disclosure, and Corporate Privacy: A Comment*, 9 J. Legal Stud. 819 (1980) (insider trading); Note, *A Reconsideration of the Stock Market Exception to the Dissenting Shareholder's Right of Appraisal*, 74 Mich. L. Rev. 1023, 1040-44 (1976) (shareholder rights in corporate acquisitions).

² See, e.g., W. Klein, *Business Organization and Finance: Legal and Economic Principles* 241-43 (1980); R. Posner & K. Scott, *Economics of Corporation Law and Securities Regulation* 155-94 (1980); R. Pozen, *Financial Institutions: Cases, Materials and Problems on Investment Management* 139-86 (1978); D. Ratner, *Institutional Investors: Teaching Materials* 67-95 (1978); L. Soderquist, *Securities Regulation: A Problem Approach* 173-77 (1982); L. Solomon, R. Stevenson & D. Schwartz, *Corporations Law and Policy: Materials and Problems* 431-53 (1982). There remain exceptions. See, e.g., R. Jennings & H. Marsh, *Securities Regulation: Cases and Materials* xix-xx (5th ed. 1982) ("[S]pace does not permit, nor are we convinced of the utility of, the inclusion of diverse and irreconcilable economic opin-

debate over the future of securities regulation both within and without the Securities and Exchange Commission;³ it has served as the intellectual premise for a major revision of the disclosure system administered by the Commission;⁴ and it has even begun to influence judicial decisions⁵ and the actual practice of law.⁶ In short, the ECMH is now *the* context in which serious discussion of the regulation of financial markets takes place.

Yet the legal culture's remarkably rapid and broad acceptance of an economic concept that did not exist twenty years ago⁷ is not matched by an equivalent degree of understanding. The disparate ways in which the legal culture employs the ECMH share a single,

ions which might have some bearing on the legal problems presented.").

³ See, e.g., Report of the Advisory Committee on Corporate Disclosure to the Securities and Exchange Commission, 95th Cong., 1st Sess. 644-47 (House Comm. Print 95-29, 1977) [hereinafter cited as *Advisory Committee Report*]; H. Kripke, *supra* note 1.

⁴ In the Release proposing its new integrated disclosure system, the Commission stated that "the new concept of integration also proceeds from the observation that information is regularly being furnished to the market through periodic reports under the Exchange Act To the extent that the market accordingly acts efficiently . . . there seems little need to reiterate this information in a prospectus" Securities Act Release No. 6235, Proposed Comprehensive Revision to the System for Registration of Securities Offerings, [1980 Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 82,649, at 83,484. See also Executive Summary of Securities Act Release Nos. 6331-38, Proposed Rulemaking to Implement the Integrated Disclosure System [1981-1982 Transfer Binder] Fed. Sec. L. Rep. ¶ 83,016, at 84,479 ("Proposed Form S-3 relies on the efficient market theory . . .").

⁵ See, e.g., *Panzirer v. Wolf*, 633 F.2d 365 (2d Cir. 1981); *Seaboard World Airlines v. Tiger International*, 600 F.2d 355, 362 (2d Cir. 1979); *Blackie v. Barrack*, 524 F.2d 891, 907 (9th Cir. 1975); *In re Ramada Inn Securities Litigation*, 550 F. Supp. 1127, 1131 (D. Del. 1982); *In re LTV Securities Litigation*, 88 F.R.D. 134 (N.D. Tex. 1980).

⁶ See, e.g., Fischel, *Use of Modern Finance Theory in Securities Fraud Cases Involving Actively Traded Securities*, 38 Bus. Law. 1, 3-5, 4 n.9 (1982) (suggesting applications of theory to cases); Pickholz & Horahan, *The SEC's Version of the Efficient Market Theory and Its Impact on Securities Law Liabilities*, 29 Wash. & Lee L. Rev. 943 (1982) (describing recent cases and suggesting reassessment of securities law liabilities in terms of efficient market theory).

⁷ J. Lorie & M. Hamilton, *The Stock Market: Theories and Evidence* 80 (1973). The first of the modern empirical tests that underlie the ECMH, see *infra* text accompanying note 25, was published in 1959, although earlier research anticipating the same result dates back to 1900. J. Lorie & M. Hamilton, *supra*, at 71-72. It was not until the mid-1960's, however, that scholars fully specified the implications these tests held for informational efficiency. J. Lorie & M. Hamilton assign credit for full specification of this link to Benoit Mandelbrot and Paul Samuelson. *Id.* See Mandelbrot, *Forecasts of Future Prices, Unbiased Markets, and "Martingale" Models*, 39 J. Bus. 242 (1966); Samuelson, *Proof That Properly Anticipated Prices Fluctuate Randomly*, 6 Indus. Mgmt. Rev., Spring 1965, at 41. Yet full elaboration of the ECMH, as it is now conventionally employed, should probably be traced to Eugene Fama's seminal review article, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. Fin. 383 (1970).

and to us critical, commonality. They rest on legal and policy implications derived from the ECMH (particularly in its semi-strong form) without serious attention to how these implications depend on a more preliminary question: What makes the market efficient when it appears to be so?⁸

This fixation on the fact of market efficiency has also characterized much of the financial economics literature on the ECMH. Professor Jensen has stated that "there is no other proposition in economics which has more empirical evidence supporting it than the efficient markets hypothesis."⁹ Despite certain anomalies,¹⁰ numerous studies demonstrate that the capital market responds efficiently to an extraordinary variety of information.¹¹ Indeed, in the single area of financial accounting data, even the number of surveys of empirical studies of capital market efficiency is substantial.¹² But this outpouring of empirical research demonstrating market efficiency has greatly outpaced efforts to explain the phenomenon. As Professor Beaver recently acknowledged, a theory is

⁸ For a notable exception see Easterbrook, *Insider Trading, Secret Agents, Evidentiary Privileges, and the Production of Information*, 1981 Sup. Ct. Rev. 309, 335-37 (discussing insider trading and stock prices).

⁹ Jensen, *Some Anomalous Evidence Regarding Market Efficiency*, 6 J. Fin. Econ. 95, 95 (1978).

¹⁰ For a discussion of recent evidence that the market may not respond with total efficiency to certain novel or ambiguous forms of public information, see *infra* text accompanying note 205. In addition, recent studies of the volatility of securities prices have proven difficult to reconcile with both the ECMH and existing models of equilibrium market prices. See, e.g., S. Sheffrin, *Rational Expectations* 141-46 (1983) (reviewing studies); Shiller, *Do Stock Prices Move Too Much To Be Justified by Subsequent Changes in Dividends?*, 71 Am. Econ. Rev. 421, 421 (1981). These studies pose difficult interpretative problems in their own right. See Leroy, *Efficiency and the Variability of Asset Prices*, 74 Am. Econ. Rev. 183 (1984). Yet even if problems are finally resolved against current formulations of the ECMH, "the basic insights of the efficient markets literature [would] still remain." S. Sheffrin, *supra*, at 123. No one suggests, for example, that the market does not respond efficiently to easily interpreted forms of public information, see *infra* text accompanying note 26. Indeed, a satisfactory theoretical account of the ECMH empirical tests would be the natural starting point for analysis of the recent, and still tentative, volatility literature.

¹¹ This literature is surveyed *infra* note 26.

¹² See, e.g., G. Foster, *Financial Statement Analysis* (1978); P. Griffin, *Usefulness to Investors and Creditors of Information Provided by Financial Reporting: A Review of Empirical Accounting Research* (1981). One of the early researchers in this area recently wrote that when "asked to do a paper surveying empirical research in accounting, I found it difficult to believe that the world needed yet another survey on this topic." Kaplan, *The Information Content of Financial Accounting Numbers: A Survey of Empirical Evidence in The Impact of Accounting Research on Practice and Disclosure* 134, 134 (A. Abdel-Khalik & T. Keller eds. 1978).

needed to "complement the predominantly empirical tradition of efficient market research The empirical findings have largely preceded a formal, conceptual development of market efficiency."¹³ Thus, legal users of the ECMH literature have been, by and large, confronted with a body of empirical evidence in search of a causative theory.

In recent years, however, financial economists have found the absence of an explanation for market efficiency increasingly troubling. To be sure, the phenomenon of market efficiency is easily explained under perfect market assumptions—for example, that information is immediately and costlessly available to all participants in the capital market. But this explanation is, in the words of a joke commonly directed at both lawyers and economists, "absolutely accurate and totally useless."¹⁴ In commenting on Fama's seminal review article on market efficiency,¹⁵ Professor Sharpe has made precisely this point: "Simply put, the thesis is this: in a well-functioning market, the prices of . . . securities will reflect predictions based on all relevant and available information. This seems almost trivially self-evident to most professional economists—so much so, that testing seems almost silly."¹⁶ What makes the ECMH non-trivial, of course, is its prediction that, even though information is *not* immediately and costlessly available to all participants, the market will act *as if* it were.

¹³ Beaver, *Market Efficiency*, 56 *Acct. Rev.* 23, 24 (1981). See Figlewski, *Market "Efficiency" in a Market with Heterogeneous Information*, 86 *J. Pol. Econ.* 581, 596 (1978) ("Discussions of the efficient-markets model seldom specify precisely how the market processes information to produce a price that accurately discounts it."); Verrecchia, *On the Theory of Market Information Efficiency*, 1 *J. Acct. & Econ.* 77, 77 (1979) ("Despite the substantial empirical evidence in support of the efficient market hypothesis, information efficiency has proved difficult to interpret in a compelling way"). These commentators refer to the lack of a causative theory of market efficiency. Beginning with Samuelson's pioneering work, *supra* note 7, economists have offered formal models whose efficiency is explainable.

¹⁴ The story usually begins with two people in a hot air balloon who discover they have lost their way. They notice someone on the ground and call out, "Where are we?"

Unhesitatingly the ground observer responds, "You're in a balloon."

At this point one balloonist turns to the other and says, "He must be a lawyer (economist)."

"How can you tell?" the second passenger asks.

"It's easy," the first responds. "What he said was absolutely accurate and totally useless."

¹⁵ Fama, *supra* note 7.

¹⁶ Sharpe, *Discussion*, 25 *J. Fin.* 418, 418 (1970). Professor Beaver has made a similar point more recently: "Why would one ever expect prices *not* to 'fully reflect' publicly available information? Won't market efficiency hold trivially?" Beaver, *supra* note 13, at 32.

The challenge of explaining why the market can behave efficiently despite the fact that information—even publicly “available” information—is costly to obtain and process, has led financial economists to formulate models of market mechanisms that, under carefully specified circumstances, can cause the capital market to act as if everyone were costlessly informed even though they are not.¹⁷ But although these models are all intuitively persuasive, they nonetheless differ in important respects in their specification of how the capital market achieves efficient prices. Thus, despite the substantial progress that has been made, we still lack a single, comprehensive explanation for the existence of market efficiency.

The absence of such a unified explanation of market efficiency presents a serious problem for those judges, lawyers, and regulators who would rely upon the ECMH as the basis for judicial or regulatory policy making. When market efficiency serves as a basis for reform—as it has done, for example, for recent changes in the disclosure requirements of the Securities and Exchange Commission¹⁸—before we clearly understand why the capital markets are efficient in the first place, we risk interfering with the very condition that originally made reform desirable. On a more positive note, an understanding of the mechanisms of market efficiency should allow the design of more effective reform.

In this article, we propose a general explanation for the elements that lead to—and limit—market efficiency. Our analysis integrates not only the disparate capital market mechanisms that appear in the financial economics literature, but also the interaction between these mechanisms and the information market, which we believe is central to an understanding of capital market efficiency.¹⁹ Focusing on the information market, in turn, allows us to draw on another body of recent literature whose significance for the analysis of market efficiency has only recently become apparent. This is the

¹⁷ We discuss these models in detail in Section II.

¹⁸ See *supra* note 4.

¹⁹ Others have made this point. See T. Copeland & J. Weston, *Financial Theory and Corporate Policy* 198-204, 210-11 (1979); Gonedes, *The Capital Market, The Market for Information, and External Accounting*, 31 *J. Fin.* 611, 628 (1976). They have not, however, pursued the insight in search of an integrated explanation of capital market efficiency. In a more limited context, Campbell and Kracaw have recognized the need for simultaneous equilibria in both the capital market and the market for information in order to explain the informational role of financial intermediaries. Campbell & Kracaw, *Information Production, Market Signalling, and the Theory of Financial Intermediation*, 35 *J. Fin.* 863, 865 (1980).

literature that details the role of transactions costs in shaping market arrangements.²⁰

We begin in Section I with a necessary preliminary: clarifying precisely what is meant by the term market efficiency. Section II then surveys the several capital market mechanisms that have been offered as explanations for market efficiency. We argue that, rather than being alternatives, these market mechanisms are *all* potentially operative. Which mechanism operates with respect to a particular piece of information, and, ultimately, how efficient the capital market is with respect to that information, depends upon the initial distribution of the information among traders. This focus on the distribution of information as a determinant of capital market efficiency sets the stage for consideration in Section III of the structure of the market for information. Here, we argue that the distribution of information among traders is a function of information costs, and that many familiar market institutions, such as investment banks, serve the function of reducing information costs, and thereby facilitate efficiency in the capital market. Section IV completes a synthesis of the workings of the capital and information markets and demonstrates its value by analyzing two theoretical problems: the role of investment bankers in achieving market efficiency; and the persistence of an efficient market response to some forms of information despite the constraint that traders must earn a return on their investment in information. Finally, Section V examines the implications of our synthesis for two current policy issues: the role of insider trading as a means of achieving more accurate securities prices; and the implications of empirical studies intended to demonstrate that compulsory disclosure by issuers under the Securities Exchange Act of 1934²¹ has not benefited investors.

I. PRELIMINARY DEFINITIONS

The language of efficient capital market theory reveals its origins as a vocabulary of empirical description. The common definition of market efficiency, that "prices at any time 'fully reflect' all available information,"²² is really a shorthand for the empirical

²⁰ We discuss this literature *infra* text accompanying notes 157-63.

²¹ 15 U.S.C. § 78a-kk (1982).

²² Fama, *supra* note 7, at 383.

claim that "available information" does not support profitable trading strategies or arbitrage opportunities.²³ Similarly, Eugene Fama's landmark 1970 review article first proposed the now-familiar division of the ECMH into "weak," "semi-strong," and "strong" forms as a device for classifying empirical tests of price behavior.²⁴ Weak form tests examined the claim that the histories of securities prices could not yield lucrative trading opportunities.²⁵ Semi-strong form tests probed the same prediction about categories of publicly available information of obvious interest to investors.²⁶ Finally, strong form tests examined the extension of the hypothesis to information that was available only to particular

²³ Unless its key terms are specified, this definition lacks empirical value. See *id.* at 384-85. Its ambiguities are innocuous, however, so long as it is identified with arbitrage opportunity tests.

²⁴ *Id.* at 383, 388. Fama credited Harry Roberts with distinguishing weak and strong form tests. *Id.* at 383 n.1.

²⁵ *Id.* at 389-96 (review of tests).

Numerous weak form tests support the hypothesis that the history of securities prices does not yield exploitable trading opportunities. For overviews supplementing the Fama review, see K. Garbade, *Securities Markets* 241-49 (1982); J. Lorie & M. Hamilton, *supra* note 7, at 75-82. Generally, these tests take two forms: serial correlation analyses, which establish little or no relationship between changes in securities prices over successive periods, K. Garbade, *supra*, at 241-47; and analyses of "filter rule" trading strategies, which reject the possibility that trading on more complex patterns of price movements of the sort employed by "chartists" can yield abnormal returns, *id.* at 247-49. See E. Fama, *Foundations of Finance, Portfolio Decisions and Securities Prices* 139-41 (1976). See also K. Garbade, *supra*, at 241 (varieties of weak form tests); Fama, *The Behavior of Stock-Market Prices*, 38 *J. Bus.* 34, 45 (1965) (results of correlation tests covering 30 stocks over five-year period); Fama & Blume, *Filter Rules and Stock-Market Trading*, 39 *J. Bus.* 226 (1966) (extensive testing of filter rules). For a review of the simple assumptions about market pricing behavior that underlie these tests, see E. Fama, *supra*, at 149-51.

²⁶ Fama, *supra* note 7, at 383, 404-09 (reviewing empirical tests).

Studies of semi-strong form efficiency are tests of *how long* market prices require to adjust to price-relevant information that is released to the public. These studies typically ask whether trading activity that follows the release of such information can earn investors abnormally high returns and focus on the security's price history before and after the test period. See K. Garbade, *supra* note 25, at 250. The discovery of abnormal returns indicates trading opportunities and, therefore, possible market inefficiency. The results thus far indicate efficient price responses to a wide variety of publicly released information, ranging from earning reports and dividend announcements to accounting changes, stock splits, press evaluations, and even changes in Federal Reserve Board policy. For representative surveys with which to supplement the Fama review, see T. Copeland & J. Weston, *supra* note 19, at 222-44; G. Foster, *supra* note 12, at 332-59; K. Garbade, *supra* note 25, at 249-59; Kaplan, *supra* note 12, at 134-51, 156-62, 166-68. Not all semi-strong form tests indicate market efficiency, however. See *infra* note 205 (citing studies finding inefficiencies). We discuss in Section IV the implications that these atypical results hold for the distinction between weak and semi-strong form tests.

groups of privileged investors.²⁷ In this usage, the weak, semi-strong, and strong form categories have proved both useful and precise. The hypothesized dearth of arbitrage opportunities, whatever its explanation, clearly grows in strength with each successive genre of test. The more private the information, the more intuitively reasonable the proposition that one might profit by trading on it, and so the stronger the opposing claim that such profitable trading is impossible.

Over time, however, scholars have pressed the weak, semi-strong, and strong form categories beyond their original service as a classification of empirical tests into more general duty as a classification of market responses to *particular kinds of information*. For example, prices might be said to incorporate efficiently one genre of information that is semi-strong or public, but fail to reflect another that is strong form, or non-public. Indeed, taken a step further, scholars sometime describe markets themselves as weak, semi-strong, or strong form efficient.²⁸ Without ever being quite explicit, this powerful shorthand implies that different market dynamics

²⁷ Fama, *supra* note 7, at 409-13 (reviewing strong form tests).

Unlike weak and semi-strong form tests, which probe for trading opportunities that might arise from particular *kinds* of information, see *supra* notes 25-26, strong form studies cannot test for analogous opportunities arising from the generation of non-public information because investigators are unlikely to learn about such information (or if they do, they are unlikely to employ it for research purposes). For this reason, strong form tests must probe indirectly for trading opportunities arising from non-public information. Such tests seek to identify investors who are likely to possess non-public information and to determine whether these traders consistently earn net returns higher than the market average. The results have been mixed. Corporate insiders, such as officers, directors and affiliated bankers, systematically outperform the market. So do specialists on the major stock exchanges who possess non-public information about unexecuted investor orders. See, e.g., Baesel & Stein, *The Value of Information: Inferences from The Profitability of Insider Trading*, 14 J. Fin. & Quantitative Analysis 553 (1981) (corporate insiders); Lorie & Niederhoffer, *Predictive and Statistical Properties of Insider Trading*, 11 J.L. & Econ. 35, 52-53 (1968) (corporate insiders); Niederhoffer & Osborne, *Market Making and Reversal on the Stock Exchange*, 61 J. Am. Stat. A. 897 (1966) (exchange specialists). Mutual funds, however, appear to outperform the market only well enough to cover administrative and trading costs. See Jensen, *The Performance of Mutual Funds in the Period 1945-1964*, 23 J. Fin. 389, 418 (1968); Mains, *Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios: Comment*, 50 J. Bus. 371, 384 (1977) (reanalyzing Jensen data and noting that Jensen's conclusion that mutual funds were inferior performers should be revised to call them neutral performers). For discussion of these results, see *infra* text accompanying notes 70-72.

²⁸ See, e.g., K. Garbade, *supra* note 25, at 241, 249-50, 259-60 (1982) ("weak," "semi-strong," and "strong form" efficient markets defined); Figlewski, *supra* note 13, at 582 ("A market is weakly efficient if the current price . . . discounts the information contained in the history of past market prices.").

are involved in the reflection of different kinds of information into price, and that varying degrees of market efficiency might well be the consequence.

The recognition that different market mechanisms operate on different types of information is central to our analysis of market efficiency. But before we explore this conclusion in greater detail, it is first necessary that we define the key terms of the ECMH, and that we do so conceptually rather than operationally. Four basic concepts are critical. Two of these are encompassed within the operational definition of market efficiency: that prices "fully reflect" all "available" information. The third inheres in the expanded use of the weak, semi-strong, and strong form categories to describe price response to different kinds of information. We need a concept of "relative efficiency" that distinguishes among and ranks the different market dynamics according to how closely they approximate the ideal of ensuring that prices *always* fully reflect all available information. Finally, we need a working definition of the most basic concept of all, that of "information," in order to specify the processes by which price comes to reflect not only the actual occurrence of events, but also changes in perceptions of the probability of future events.

It is our good fortune here, as at several junctures in this analysis, to have at hand prior work that provides major elements of the theoretical structure required by our discussion. The ambiguities inherent in the loose operational terminology of efficient market theory have led several commentators, including Beaver,²⁹ Rubinstein,³⁰ and Fama himself,³¹ to propose restatements of the basic price-oriented definition of market efficiency. Their efforts have focused on clarifying the first two concepts, that prices "fully reflect" all "available information." Following Beaver's analysis, the requirement that prices "fully reflect" information means that prices must behave "*as if* everyone knows" the relevant information.³² Full reflection of information, then, entails a hypothetical

²⁹ Beaver, *supra* note 12, at 27-31.

³⁰ Rubinstein, *Securities Market Efficiency in an Arrow-Debreu Economy*, 65 *Am. Econ. Rev.* 812, 812 (1975).

³¹ E. Fama, *supra* note 24, at 134-37; Fama, *supra* note 7, at 384-88.

³² Beaver, *supra* note 12, at 28. Beaver attributes this definition to William Sharpe and notes its similarity to the proposals of Rubinstein, *supra* note 30, and Beja. Beaver, *supra* note 12, at 28 n.11.

identity between two equilibria in the same market: the equilibrium that would result if everyone knew the information, and the equilibrium that is actually observed. The market is efficient if (and when) the two equilibria are identical.³³ The effect of this reformulation is to shift our attention away from the operational consequences of efficiency for traders and toward the challenge of describing the market processes of price formation.

By contrast, the second basic concept embodied in the operational definition of market efficiency, that prices mirror all available information, is less in need of reformulation than of expansion. The availability of information is a function of its distribution among traders in a given market. Different "bits" of information are more or less "available" depending on how many traders are aware of them.³⁴ Thus, the strength of the claim that prices fully reflect *all* available information hinges in large part on where one sets the minimum threshold of information distribution. Strong form market efficiency tacitly sets the threshold as low as possible, by describing information as "available" if it is accessible to only a single individual even if no one actually trades on it. The consequence, as Fama has observed, is an "extreme null hypothesis" that cannot literally be true.³⁵ Weak form market efficiency, on the other hand, implicitly sets the distributional threshold as high as possible. Information about prices in the recent past, for example, is likely to be distributed to all traders in a single market. Indeed, for traders who are continuously active in the market, the distribution of this type of information may follow from the fact of trading itself.

Because different distributions may place information anywhere between these extremes of high and low "availability" to traders, our concern must be with particular categories or "sets" of infor-

One critical attribute of the Sharpe-Beaver definition is that it imposes few restrictions on the beliefs of individual traders. It can be interpreted to require a "consensus" among traders about the price import of new information, but it does not require actual homogeneity of belief. *Id.* at 29-30. For a review of alternative definitions of market efficiency, see *id.* at 30-31.

³³ *Id.* at 28.

³⁴ The distribution of information among traders, in turn, is a function of its cost. See *infra* text accompanying notes 143-67. Because the cost of information is determined by factors outside the capital market, we postpone its discussion for now. See *infra* Part III (The Information Market).

³⁵ Fama, *supra* note 7, at 388.

mation rather than with information in general. An efficient market response to one information set does not necessarily mean that the market will respond efficiently to a different set; it may or may not, depending on the analytical framework that informs our initial partitioning of information sets. For example, Fama's original tripartite classification of efficiency tests explicitly permits differentially efficient market responses to the information sets sampled by each category of test.³⁶ This classification also implies, however, that a finer partitioning of the three information sets should not yield a hitherto untested, anomalous subset that can support lucrative trading opportunities.³⁷ It is this tacit recognition—that the weak, semi-strong, and strong form tests each sample a particular information set with potentially unique efficiency characteristics—that permits the expansion of the weak, semi-strong, and strong form trichotomy into a shorthand system for partitioning information sets. The additional use of the trichotomy as a means of classifying *markets* only highlights further the implicit assumption that different information sets implicate their own processes of price formation and their own efficiency dynamics.

In clarifying the operational definition of market efficiency—that prices fully reflect all available information—we have suggested that different market mechanisms may be responsible for the reflection in price of differentially available categories of information. Differences among market mechanisms will matter, however, only if these mechanisms operate with unequal results. We still require a measure of success—a yardstick of “relative efficiency”—in order to assess the importance of differences in the mechanisms of price formation.

The formal definition of informationally efficient prices does not provide such a yardstick. To say, without more, that sooner or later prices will reflect certain information only describes the

³⁶ Fama, *supra* note 7.

³⁷ For example, generalizations about the results of weak form tests imply confidence that additional studies of new and more elaborate filter rules, see *supra* note 25, will not reveal market inefficiency.

A more precise delimitation of information sets distinguishes between “signal” and “information” sets. The former consists only of an observed signal; the latter consists of all information, including nonobservable information of the type that is sampled by the signal. The point of the distinction is that the market may be efficient with respect to the narrower set but not with respect to the broader set. See Beaver, *supra* note 13, at 28-30.

endpoint of a process that by itself is not very interesting or surprising.³⁸ We learn something by fixing this endpoint, of course: that the price *disequilibrium* generated by new information³⁹ ultimately evolves to a new equilibrium with the same efficient prices that would result if all traders initially possessed the new information. But this description of the restoration of efficient prices ignores all aspects of the process itself, including the most critical: *How long does it take?*

The operational definition of market efficiency tightly restricts the speed of the market's response to new information by requiring prices to reflect such information "always"—i.e., very promptly.⁴⁰ It is a short step from this emphasis on the rapidity of price response to a definition of "relative efficiency." The market, and the mechanisms that operate to reflect new information in price, are more or less efficient depending on how quickly they yield efficient equilibrium prices; relative efficiency is a measure of the speed with which new information is reflected in price. Similarly, the relative efficiency of market mechanisms determines the magnitude of arbitrage opportunities that new information creates for the fortunate traders who "know" it first. The requirement that prices *always* reflect new information means, in effect, that these mechanisms must function rapidly enough to foreclose any exploitable trading opportunities. This result is the benchmark against which claims of market efficiency are ordinarily measured. Thus, when we speak simply of the "efficiency" with which market mechanisms incorporate information into price, we will use this term in its relative sense.

The final and most difficult concept that requires clarification is

³⁸ As Beaver has observed:

Unless individuals are characterized as throwing away something of value, information is not used because it is costly. Yet much of the empirical research has examined market efficiency with respect to publicly available information . . . Why would one ever expect prices *not* to "fully reflect" publicly available information? Won't market efficiency hold trivially?

W. Beaver, *Financial Reporting: An Accounting Revolution* 158 (1981). He notes, however, that differences might exist because of information costs. *Id.*

³⁹ See Hirschleifer & Riley, *The Analytics of Uncertainty and Information—An Expository Survey*, 17 *J. Econ. Lit.* 1375, 1411-14 (1979).

⁴⁰ In addition to the speed of the market's adjustment, we will consider the shape of the path it takes to the new equilibrium. Specifically, we will ask whether the speed of adjustment is constant or whether it varies at different stages of the adjustment. See *infra* text accompanying notes 127-30.

that of information. In the broadest sense, information is data that has the capacity to alter one's beliefs about the world or, in our more limited context, one's beliefs about the appropriate price of an asset. For our purposes, however, it is useful to distinguish between two different types of information bearing on asset price: the "hard" information of known facts, and the "soft" information of forecasts and estimates.

The fact-forecast dichotomy rests on a distinction between the fixed past and the uncertain future. Imagine a trader who enjoyed absolutely certain knowledge about all past or present events that bore on the pricing of securities. This knowledge would include all the hard facts, which would be known with certainty precisely because they concerned events or outcomes that had already occurred. But even this fully informed trader would lack a type of information critical to price determination. Because securities prices ultimately turn on expectations about future earnings, hard information, in this wholly certain sense, would hardly be the only information of interest. Even a trader fully informed about the past would wish to have access to optimal forecasts about future events that seemed likely to affect future cash flows.⁴¹ And because

⁴¹ Put somewhat differently, the valuation of a capital asset is itself a master forecast of a future earnings stream, which builds on facts (e.g., last year's reported profits) and subsidiary forecasts (e.g., next year's expected profits). Valuation, then, is a two stage process, involving both the acquisition of relevant facts and forecasts and their use in estimating an appropriate market price.

Models of equilibrium market prices, including the widely-accepted capital asset pricing model (CAPM), necessarily make simplifying assumptions about both the acquisition and the processing of information. For example, the CAPM is a "two-factor" model that—supported by considerable empirical evidence—posits that the only forecasts relevant to determining a security's equilibrium price concern its systematic risk and expected returns. See Jensen, *Tests of Capital Market Theory and Implications of the Evidence*, in *Handbook of Financial Economics* 13, 37 (J. Bicksler ed. 1979). To explain discrepancies in the empirical results, however, one might suppose that factors other than systematic risk and expected return have an effect on share prices, without attempting to explain *why* they do so. See, e.g., J. Van Horne, *Financial Management and Policy* 70-71 (6th ed. 1983); Ross, *The Arbitrage Theory of Capital Asset Pricing*, 13 *J. Econ. Theory* 341 (1976) (discussing need for additional assumptions).

Similarly, the CAPM assumes homogeneity of beliefs about systematic risk on the part of traders, which in our terms means the acquisition of identical facts and forecasts. J. Van Horne, *supra*, at 66. By definition there is homogeneity of beliefs in a world of fully informed investors. In actual markets, however, investors may acquire different information and make different forecasts. The basic tenets of the CAPM remain valid when these differences are moderate. *Id.* (impact of moderate homogeneity is to make the capital market line—the relationship between expected return and systematic risk—"fuzzy"). Where heter-

of the inherent complexity of the events on which such forecasts depend, they would necessarily be cast as probability distributions displaying the likelihood of a range of possible outcomes. The particular shape of these distributions would derive from facts, subsidiary inferences, and the best available forecasting technology; but the very impossibility of complete certainty about the future forces expectations about future events into the mold of probability distributions.

The dichotomy between certain facts and uncertain forecasts represents the central static distinction between types of information that our analysis requires.⁴² It remains necessary, however, to consider an element of the dynamic aspect of information as well. Recall the example of the hypothetical fully informed trader. At any particular time, this trader has complete information about the past and present and a set of expectations about the future. But now assume that he acquires a new "bit" of information, whether hard or soft. This acquisition increases his total store of information, but it may also alter some or all of the information he already holds. For example, the acquisition of a new piece of "hard" information of major importance is likely to affect the trader's master forecast of price not only directly but also indirectly, by altering the information on which much of his "soft," or forecast information is based.⁴³ In this sense, the structure of trad-

ogeneity becomes more pronounced, however, one would expect increasingly inefficient prices, at least as judged by the yardstick of the CAPM. See, e.g., Figlewski, *Information Diversity and Market Behavior*, 37 J. Fin. 87, 101 (1982) (heterogeneous expectations as obstacles to short and long run equilibrium prices); Miller, *Risk, Uncertainty, and Divergence of Opinion*, 32 J. Fin. 1151, 1153-54 (1977) (badly informed investors tend to overprice risky assets). Thus, it is not only the ECMH, but also the assumptions underlying the CAPM, that depend critically on the speed with which the market efficiency mechanisms operate.

⁴² A second static distinction would be the further division of soft information into "soft" and "very soft" categories. Soft information would be that gleaned from objective probability distributions, such as the response of price to routine contingencies. Very soft information would be that obtained from largely subjective probability distributions, such as the range of price responses to a wholly innovative security. See F. Knight, *Risk, Uncertainty and Profit* 233 (1921); *infra* text accompanying notes 111-13. Full development of this distinction, however, would raise a host of problems with only tangential relevance to our analysis. For a discussion of some of these problems in the context of forecasting, see Kantor, *Rational Expectations and Economic Thought*, 17 J. Econ. Lit. 1422, 1433-35 (1979).

⁴³ For example, new information about an issuer's unexpected loss on a major product line can *directly* reduce the total value of the issuer's securities by diminishing its expected future income to the extent of the unanticipated amount of the loss. This information may

ing information is holistic and hierarchical rather than additive and democratic. New information may act either as an overlay to an entire range of previously acquired information, or as a fine-tuning and confirmation of an existing aspect of trader expectations.

The distinction between hard—certain—information and uncertain forecast portrays a constant movement toward certainty. Uncertain information inevitably becomes more certain as the acquisition of new data either confirms or alters the old information and thereby renders it “new.” Similarly, any change that new information induces in the forecast of future events also results in “new” information. A forecast that an event has a fifty percent likelihood of occurrence is different information from one that projects a nearly certain probability of occurrence.

Thus far, however, we have described the hierarchical interaction between new information and old, and the resulting transmigration of old information into new, as a passive phenomenon. The passage of time alone reduces uncertainty and, in turn, the reduction of uncertainty confirms or alters our expectations about value. But the reduction of uncertainty is seldom a wholly passive phenomenon in the real world. Market participants often engage in *active* attempts to reduce uncertainty about unknown or future events. In order to understand the active response to uncertainty,⁴⁴ we must abandon our hypothetical of the fully informed trader and shift instead to traders who, like the rest of us, are less than fully informed.⁴⁵

Uninformed investors may actively attempt to reduce uncertainty in three different ways. First, investors who lack either hard or soft information may act to acquire it, rather than waiting pas-

also reduce total value *indirectly*, by lowering trader estimates of the likely performance of the issuer's other products or the quality of its management. The acquisition of many secondary facts of minor importance may affect the trader's assessment of value *only* by altering the probability distributions associated with one or another of his forecasts. Much the same distinction holds true for the acquisition of new soft information. The formation of some new forecasts will also alter existing forecasts whenever the newly projected events bear on the probability distributions underlying such forecasts. But the impetus to make certain secondary forecasts will stem directly from their value in refining the probability distributions associated with the existing set of primary forecasts.

⁴⁴ See Hirshleifer & Riley, *supra* note 39, at 1376-77.

⁴⁵ It is, of course, the fact that investors are *not* fully informed that prompts the search for market efficiency mechanisms in the first place.

sively for the passage of time to reveal it to them. Second, traders may attempt to derive more benefit from the store of information that they already possess. Study of existing information may provide new understanding of its implications or of its relationship to other information, thereby confirming or altering one's existing forecast of value.⁴⁶ Finally, traders may attempt to ascertain the accuracy of information that they have obtained from others. Most trading facts are acquired second-hand from sources of widely varying credibility. Traders frequently learn the surface content of alleged facts but remain uncertain about their accuracy. The third response to uncertainty is the effort to resolve these doubts, either through study or the acquisition of new facts.⁴⁷

Our description of the concept of information thus ends with a focus on its role in dissipating uncertainty about the future and by

⁴⁶ Even data about recent price changes, which alone possess little or no trading value, see *supra* note 25, may yield valuable insights when interpreted in conjunction with other, less widely distributed information. See *infra* text accompanying notes 84-91 (discussing derivatively informed trading).

⁴⁷ Consider the example of a securities analyst who is told by a former employee of an insurance company that the company has been fabricating its policies in order to create the illusion of earnings. The fabrication of policies is a critical matter of fact. But insofar as the employee's allegation of fraud is suspect, the analyst does not learn the hard fact of fraud, but only its imperfect proxy—the hard fact of the employee's report. For the analyst, the fraud itself remains a projection whose value hinges on an estimate of its reliability.

Put in simple expected value terms, if the analyst believes that the damning information about the insurance company warrants a reduction of its current stock price from \$30 to \$10, the information has a value that can be measured by merely multiplying the number of shares the analyst can sell short by \$20. If, however, the analyst doubts the accuracy of the information, its value changes. Suppose the analyst believes there is a 50% chance that the information is incorrect and that the company's next release of audited financial statements will result in a \$20 increase in the price of the stock. Assuming risk neutrality, the information then will not change the analyst's expected value of the insurance company's stock, because the two alternatives, having equal opposite values and equal likelihoods of occurring, balance exactly. But now suppose that the analyst acquires other information that further alters his belief about the likelihood that the initial information is correct. If the analyst then believes the original information has a 70% likelihood of being correct, his belief concerning the value of the insurance company's stock changes; there is now a 70% likelihood of a \$20 drop in price and a 30% likelihood of a \$20 increase in price, resulting in a net downward shift of \$8 in the analyst's belief about the correct stock price.

The analyst may reduce uncertainty by undertaking active efforts to verify the accuracy of the information. And just as with the other active responses to uncertainty, this effort serves to change the initial information by altering or confirming it. A statement that a condition certainly exists is a different statement from one asserting only a 50% probability of the condition's existence. Indeed, a single statement about the world can be one of an infinite number of different statements—different pieces of information—depending on its perceived degree of accuracy.

emphasizing three types of informational activity that a trader may undertake to reduce uncertainty: efforts to acquire additional information, efforts to refine forecasts and deepen the predictive value of information already in hand, and efforts to determine the accuracy of information already in hand. We will return to this typology in Section III when we describe the operation of the market for information, a market whose existence stems from the demand for precisely these kinds of efforts and whose analysis must proceed on their terms.⁴⁸ For now, however, we have completed our task of clarifying the concept of information in the context of trading markets. Since this also concludes our broader aim of clarifying the key terms of the ECMH, we can now turn to an account of the mechanisms of market efficiency. In a very real sense, this new task is no more than clarification of the dynamic aspect of market efficiency. An account of market mechanisms makes explicit the processes of price change that the original operational definition of market efficiency implicitly recognized by its emphasis on the differential availability of arbitrage opportunities.

II. MECHANISMS OF MARKET EFFICIENCY

Review of the basic vocabulary of efficient market theory reveals a missing link: an account of the mechanisms of market efficiency that its terms foreshadow but do not explicitly detail. Once the "full reflection" of information into price is reformulated as an identity between an existing equilibrium price and a fully informed equilibrium price, the general contours of these mechanisms become clear. They must be trading processes that, with more or less promptness (or "relative efficiency"), force prices to a new, fully informed equilibrium. Moreover, clarifying the meaning of informational "availability" also reveals the chief obstacle to any mechanism that serves to push prices toward a fully informed equilibrium. New information is "available" to the capital market under an extraordinary variety of circumstances, ranging from the extreme of near-universal initial distribution of information—when everyone really does know the information—to the opposite extreme of initial distribution to only a very few traders.⁴⁹ A satisfac-

⁴⁸ See *infra* text accompanying notes 131-35 (taxonomy of information costs).

⁴⁹ Similarly, there may be partial distribution of the information to only some traders, without "complete" distribution to any. Partial distribution of soft information may occur

tory account of the mechanisms of market efficiency must describe their operation over this entire continuum of availability, including those circumstances in which the initial distribution is extremely limited or incomplete. Finally, and most important, the insight implicit in the extended application of the weak/semi-strong/strong form categories to information sets and markets suggests how one can explain distinct levels of relative efficiency over the entire continuum of informational availability. We must search for *several different mechanisms*, each of which can operate over an information set of particular availability to market traders, and each of which can generate its own dynamics of price equilibration.

Fortunately, the most difficult step in this search—the identification of a basic repertoire of mechanisms to explain the incorporation of new information into equilibrium securities prices—has already been taken. Over the past dozen years, financial economists have proposed four general forms of mechanisms, which may be termed “universally informed trading,”⁵⁰ “professionally informed trading,”⁵¹ “derivatively informed trading,”⁵² and “uninformed trading.”⁵³ In accordance with the economists’ rigorous conventions of formal exposition, each of these mechanisms has thus far been modeled in isolation, as if it singlehandedly could explain the dynamics of price equilibration. Yet from the perspective of policy formulation, the precise operation of these mechanisms *in vacuo* is of less interest than the fact that all four shape the formation of prices in the same securities markets. Moreover, they do so in a fashion that can account for the reflection of information in price over the entire range of informational availability. We shall present these four mechanisms as components of a single complex repertoire of market responses. Our contribution lies not in identifying a new efficiency mechanism, but in specifying how the “fit” among the original four can supply the foundations for an explicit account of price equilibration.

where traders imperfectly forecast matters of fact. Partial distribution of hard information may occur where traders acquire unreliable reports on matters of fact. See *supra* text accompanying notes 40-48 (“information”); *infra* text accompanying notes 96-123 (“uninformed trading” mechanism).

⁵⁰ See *infra* text accompanying notes 58-60.

⁵¹ See *infra* text accompanying notes 61-72.

⁵² See *infra* text accompanying notes 73-95.

⁵³ See *infra* text accompanying notes 96-123.

Three features of the relation among the market mechanisms are critical. First, only one of the market mechanisms at a time can ordinarily operate to cause a particular bit of new information to be reflected in price. Second, which mechanism will dominate the dynamics of price change at any time depends on how widely the particular information is distributed in the market.⁵⁴ Third, each of the mechanisms operates with a characteristic level of relative efficiency that depends on how widely information must be distributed in order to trigger it. The wider the initial distribution of information that a mechanism requires, the more rapidly that mechanism operates.

Together, these characteristic interrelationships permit us to array the four market mechanisms on a continuum based on the initial distribution⁵⁵ of information among traders, that is, on *how many* traders learn of the new information.⁵⁶ Although all four mechanisms can ultimately lead to efficient equilibrium prices, the dynamics of equilibration will take longer as one moves from wide to narrow distribution mechanisms. Thus, just as the extended use of the weak/semi-strong/strong form categories implies, less "available" information will require more time for "full reflection" in price because its narrower distribution will force a qualitatively more circuitous form of price equilibration. Correlatively, the individual trader who initially learns of new information can capture an increasing portion of its trading value as the initial distribution of the information narrows and the dominant market mechanism shifts accordingly.

⁵⁴ Recall, however, that the distribution of information to traders can fail at several distinct steps: in its acquisition, processing, or verification. See *supra* text accompanying notes 45-48.

⁵⁵ The operation of particular mechanisms may also broaden the distribution of information, and thus trigger a transition to a new dominant mechanism. See *infra* text accompanying notes 124-30. For reasons indicated in our discussion of the individual mechanisms, however, the *initial* distribution of information and the initial dominant mechanism determine the overall pace with which information is reflected in price.

⁵⁶ Alternatively, these four mechanisms may be arrayed on a continuum based on *how many trades* are initially informed by the information. This informed-trade continuum is the better formulation whenever a small fraction of traders, such as institutional investors, control a substantial percentage of the total trading volume. For simplicity of exposition, however, we use the informed-trader and the informed-trade approaches interchangeably in this section.

A. Universally Informed Trading

The simplest efficiency mechanism that causes prices to behave "as if" all traders knew of information is a market in which all traders are, in fact, costlessly and simultaneously informed. To be sure, universally informed trading in its purest sense results in efficient prices tautologically,⁵⁷ and may seem more a statement of a sufficient condition for market efficiency than an active mechanism. But several varieties of price-relevant information at least approximate the ideal of universal dissemination. "Old" information, embedded in securities prices, is one example. Ongoing market activity assures its distribution to all interested traders, and precisely because all know it, we do not expect it to reveal arbitrage opportunities in the form of lucrative screens or trading rules that all alike could exploit.⁵⁸ Another example is important news items—from presidential election results, which most citizens learn almost instantaneously, to changes in Federal Reserve Board policy, which are announced after trading hours precisely in order to ensure widespread dissemination.⁵⁹ Thus, the universally informed

⁵⁷ See *supra* text accompanying notes 14-16.

⁵⁸ See *supra* note 25 (weak form efficiency tests). Note, however, that the *interaction* of price changes and other, less widely distributed data, may reveal new information to astute traders. See *infra* text accompanying notes 85-94.

⁵⁹ In practice, of course, much of the trading impact of routine press announcements is often registered *before* publication, presumably as the result of either accurate forecasting or inside trading. See, e.g., Morse, Wall Street Journal Announcements and the Securities Markets, *Fin. Analysts J.*, Mar.-Apr. 1982, at 69, 69, 75-76 (company-specific information announced in Wall Street Journal largely anticipated); Waud, Public Interpretation of Federal Reserve Discount Rate Changes: Evidence on the "Announcement Effect," 38 *Econometrica* 231, 248-49 (1970) (Federal Reserve decisions anticipated 5-7 days in advance); SEC's Inquiry Widens As It Questions Broker, Others in Journal Case, *Wall St. J.*, Apr. 2, 1984, at 1, col. 6 (Wall Street Journal reporter admitted leaking market-sensitive information to investors). Yet the residual price response that follows publication is extremely rapid. See, e.g., Lloyd-Davies & Canes, Stock Prices and the Publication of Second-Hand Information, 51 *J. Bus.* 43, 55 (1978) (Wall Street Journal columns affect prices too rapidly to support trading profits).

Note that, even *after* the "universal" dissemination of reliable trading facts, some portion of the resulting price impact may be channelled through other market mechanisms, especially "professionally informed" and "uninformed" trading, considered *infra* text accompanying notes 61-72, 96-123. This will occur if the quality of trader expectations about "how much" good or bad news affects value differs substantially; or, what amounts to the same thing, if optimal forecast information based on widely-disseminated facts is far more narrowly distributed than the facts themselves. Cf. *supra* text accompanying notes 44-48 (typology of breakdowns in distribution of information). Under these circumstances, one would expect universal trading to account for the bulk of post-dissemination price movements and

trading mechanism ranges over all "old" price information and much that is new. It lumps together traditional "weak-form" information about price histories with information about current events into a single information set that prices reflect rapidly and with near perfect dynamic efficiency.⁶⁰

B. Professionally Informed Trading

In contrast to news about price and current events, however, much so-called "public" information is not universally disseminated among traders. Many traders are too unsophisticated to make full use of the technical accounting information contained in mandated disclosure reports;⁶¹ much disclosure data is accessible in the first instance only through documents on file with government agencies;⁶² and much information about a firm's prospects may be announced initially only to small groups of securities analysts and other market professionals.⁶³ How, then, do prices come to reflect this semi-public information? The answer, as identified in general terms by Fama⁶⁴ and many others,⁶⁵ is that rapid price equilibration does not require widespread dissemination of information, but only a minority of knowledgeable traders who control a critical volume of trading activity. From this perspective, the universally informed trading mechanism is actually only a special case of price formation through the activity of traders who are di-

expert trading to provide fine tuning. Arguably, this phenomenon explains the "technical corrections" that are often said to follow close on the heels of initial market responses to dramatic trading news. For further discussion, see *infra* text accompanying notes 111-13.

⁶⁰ For additional analysis of when readily accessible public information falls into the universally informed information set, see *infra* text accompanying notes 198-205.

⁶¹ Advisory Committee Report, *supra* note 3, at 289-98; Kripke, *The Myth of the Informed Layman*, 28 Bus. Law. 631, 632-38 (1973).

⁶² Advisory Committee Report, *supra* note 3, at 621. Access to documents of the Securities and Exchange Commission will be made much easier, however, as a result of the computerization of the Commission's records. See Sanger, *S.E.C.'s Computer Revolution*, N.Y. Times, Apr. 4, 1984, at D1, col. 3 (computerization of reports filed with SEC will allow investors to examine them through their own personal computers).

⁶³ Advisory Committee Report, *supra* note 3, at 11-14, 66-68, 621. A sample of professional securities analysts rated issuer-analyst relations programs and, in particular, personal conversations with managers, as their most valuable source of firm-specific information. *Id.* at 67.

⁶⁴ Fama, *supra* note 7, at 387-88.

⁶⁵ E.g., R. Brealey, *An Introduction to Risk and Return from Common Stocks* 17 (2d ed. 1983); J. Lorie & M. Hamilton, *supra* note 7, at 86-88. See also Advisory Committee Report, *supra* note 3, at 620-21.

rect recipients of information. Subgroups of informed traders, or even a single knowledgeable trader with sufficient resources, can also cause prices to reflect information by persistent trading at a premium over "uninformed" price levels. The rapidity of such price adjustments depends on the volume of informed trading. And although a precise account of that process has yet to be offered,⁶⁶ it seems plausible that the relative efficiency of price adjustment to new information that proceeds through professionally informed trading declines only gradually as initial access to the information narrows to a threshold minority of traders, after which it declines rapidly.⁶⁷

⁶⁶ Schwartz & Wilde, *Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis*, 127 U. Pa. L. Rev. 630, 640-51 (1979), develop a similar model for the consumer product context. They ask how many consumers must be informed in order for a product's price to be identical to one that would be charged in a market in which all consumers are perfectly informed. They conclude that the ratio of "comparison shoppers"—what we might call "professional shoppers"—to total shoppers must be sufficiently high. *Id.* The problem is more complicated in a speculative securities market, where the information to be reflected differs among professional traders, and where its reflection in price depends, in part, on the initial distribution of wealth among traders. This point is pursued in Figlewski, *supra* note 13. See also *infra* note 109 (discussing Figlewski).

⁶⁷ This account still begs the question of exactly *how* informed minority trading can lead to the rapid price reflection of new information even when the minority is too small to dominate trading volume. If uninformed traders held widely divergent beliefs about the value of a security, the short answer would be "price pressure": trading by informed investors that alters the demand or supply for particular securities, and raises or lowers their prices accordingly. This answer is almost certainly incomplete, however. It rejects wholesale the homogeneous expectations postulate of the Capital Asset Pricing Model, see *supra* note 41, as well as the depiction of securities as fungible commodities with large numbers of near-perfect risk-return substitutes. A far more plausible answer is that suggested by Myron Scholes, who demonstrated that secondary offerings affect securities prices primarily through the release of information rather than through price pressure. Scholes, *The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices*, 45 J. Bus. 179, 182-84, 206-08 (1972). See *infra* text accompanying notes 78-80 (summarizing Scholes' findings). Similarly, intense trading by an informed minority will trigger temporary fluctuations in price and volume that may, in turn, alert an uninformed majority to the existence of new information. Cf. Kraus & Stoll, *Price Impacts of Block Trading on the New York Stock Exchange*, 27 J. Fin. 569 (1972) (temporary liquidity and transaction-cost price fluctuation from block trading). The ways in which uninformed traders may "learn" from price changes are discussed *infra* text accompanying notes 78-91. The involvement of uninformed traders in the professionally informed trading mechanism would help explain the need for a threshold number of informed traders to assure the rapid reflection of new information in price. Rapid learning by uninformed traders requires a clear price signal and, therefore, a *critical volume* of informed trades. Cf. Lloyd-Davies & Canes, *supra* note 59, at 44-45, 55 (trading by security analysts' individual clients insufficient to reflect information fully in price prior to publication).

In today's securities markets, the dominant minority of informed traders is the community of market professionals, such as arbitrageurs, researchers, brokers and portfolio managers, who devote their careers to acquiring information and honing evaluative skills.⁶⁸ The trading volume in most securities that these professionals control, directly or indirectly, seems sufficient to assure the market's rapid assimilation into price of most routine information.⁶⁹ Of course, the relative efficiency of the assimilation is never perfect. Since informed trading is costly, market professionals must enjoy some informational advantage that permits them to earn a commensurate return.⁷⁰ But given competitive arbitrage and the market for analyst services, we would not expect the long-run returns of individual professionals to exceed the market average by

⁶⁸ As of 1977, 14,646 professional securities analysts were employed by investment and commercial banks, brokerage houses, mutual funds, investment counselling services, insurance companies, and miscellaneous endowments alone. Advisory Committee Report, *supra* note 3, at 36-37 (citing figures supplied by the Financial Analysts Federation).

⁶⁹ As of 1977, institutional trades, presumably directed by market professionals, accounted for 70% of public trading volume on the New York Stock Exchange. M. Blume & I. Friend, *The Changing Role of the Individual Investor* 4 (1978). Although individual investors are far more important on the smaller exchanges and in the over-the-counter market, *id.* at 5, many of these investors also depend on the informed views of market professionals. See Advisory Committee Report, *supra* note 3, at 290-91 (brokers are major information source for individual investors).

Direct estimates of *how* rapidly prices reflect information after it becomes widely accessible to market professionals are difficult to come by, but one indication may be the market's response to news of block trades. According to one study, it requires a mere 15 minutes—too short an interval for post-trade arbitrage—for prices to stabilize after such trades. Dann, Mayers & Raab, *Trading Rules, Large Blocks and the Speed of Price Adjustment*, 4 *J. Fin. Econ.* 3, 18-21 (1977). Evidence that securities with little or no analyst following sell at a discount indirectly confirms the contribution of market professionals to market efficiency. "Investors are willing to purchase neglected, 'informationally naked' securities only at a discount relative to what they would pay for comparable . . . 'informationally covered,' securities." Arbel & Strebel, *Pay Attention to Neglected Firms!*, *J. Port. Manag.*, Winter 1983, at 37, 40. There is some evidence that this phenomenon may be due in part to statistical problems with the measurement techniques used. See, e.g., Roll, *A Possible Explanation of the Small Firm Effect*, 36 *J. Fin.* 879 (1981). But more recent empirical research suggests an anomaly in return levels that cannot be entirely explained either by methodological deficiencies or by any purely economic factor, such as tax selling or higher transactions costs, suggested thus far. See Schwert, *Size and Stock Returns, and Other Empirical Regularities*, 12 *J. Fin. Econ.* 3, 3-4, 7-9 (1983) (surveying literature).

⁷⁰ A question arises, however, as to exactly *how* market professionals earn returns on routine information that is widely distributed to security analysts, and therefore reflected in price very rapidly. Must each "bit" of information, considered alone, yield marginal trading returns large enough to justify its acquisition? For discussion of this issue, see *infra* text accompanying notes 198-205.

very much, especially in exchange markets where professionals dominate trading.⁷¹ This expectation is largely confirmed by empirical studies of mutual fund returns.⁷²

In sum, the professionally informed trading mechanism explains why any information that is accessible to significant portions of the analyst community is properly called "public," even though it manifestly is not. Such information is rapidly assimilated into price, with only minimal abnormal returns to its professional recipients. And it is these characteristics, we submit, that largely convey the meaning of a "semi-strong form" market response.

C. Derivatively Informed Trading

Yet not all information is public, even within the narrow confines of the professional analyst community. Corporate insiders and exchange specialists, for example, enjoy easy access to information that would be prohibitively costly for anyone else to obtain,⁷³ while professional analysts conduct in-depth research that generates occasional informational monopolies.⁷⁴ In these and similar instances of monopolistic access, information first enters the market through a very small number of traders whose own resources are not large enough to induce speedy price equilibration. But reflection of this information in price does not depend exclusively on the trading efforts of these insiders. Derivatively informed trading enhances relative efficiency and erodes the insider's advantage by capitalizing on the "informational leakage"⁷⁵

⁷¹ See T. Copeland & F. Weston, *supra* note 19, at 211.

⁷² E.g., Jensen, *supra* note 27, at 415 (sampled mutual funds earned risk-adjusted net returns slightly below market average); Mains, *supra* note 27, at 384 (reanalyzing Jensen data to show mutual fund returns, net of operating costs, roughly equal returns on market portfolio).

⁷³ The strong form efficiency tests, *supra* note 27, amply document the systematic informational advantage enjoyed by corporate insiders and other "insider" groups. Indeed, if anything, these tests radically underestimate the magnitude of this advantage by relying on data about trades that are registered or otherwise public. Because trading on inside information is both unlawful and easily hidden, data limited only to publicly disclosed trading by insiders systematically excludes the trades most likely to reflect important informational advantages. See Keown & Pinkerton, *Merger Announcements and Insider Trading Activity: An Empirical Investigation*, 36 J. Fin. 855, 856-57 (1981).

⁷⁴ For a dramatic example, see *SEC v. Dirks*, 103 S. Ct. 3255 (1983). Lloyd-Davies & Canes, *supra* note 59, at 47-55, also provides evidence of the positive trading value of routine analyst research.

⁷⁵ See Hirschleifer & Riley, *supra* note 39, at 1409-11 (informational leakage).

associated with trading itself.

Informational leakage can assume many forms. Pure leakage—inadvertent, direct communication of trading information to outsiders—doubtlessly plays a significant role in rendering markets more efficient,⁷⁶ even if its effects remain erratic. But beyond such direct disclosure by accident or “theft,” two forms of *indirect* leakage also contribute to market efficiency. These are trade decoding and price decoding.⁷⁷

Trade decoding occurs whenever uninformed traders glean trading information by directly observing the transactions of informed traders. Myron Scholes’ classic study of secondary distributions documents a common example of this phenomenon by demonstrating that only some large block sales of stock lead to substantial, permanent declines in share price.⁷⁸ The declines are especially pronounced when sellers are officers or other insiders of the issuer; moderate when sellers are investment companies and mutual funds (which act on the advice of research staffs); and barely noticeable when sellers are individuals, bank trust departments, and other traders who may liquidate their holding for reasons other than in-

⁷⁶ A professional in a major tender solicitation firm explains the “pure” informational leakage that precedes public announcement of tender offers as follows:

You start with a handful of people, but when you get close to doing something the circle expands pretty quickly You have to bring in directors, two or three firms of lawyers, investment bankers, public-relations people, and financial printers, and everybody’s got a secretary. If the deal is a big one, you might need a syndicate of banks to finance it. Everytime you let in another person, the chance of a leak increases geometrically.

Klein, *Merger Leaks Abound, Causing Many Stocks To Rise Before the Fact*, Wall St. J., July 12, 1978, at 1, col. 6, at 31, col. 1. In the case of takeovers, Keown & Pinkerton report that approximately half of the price impact of the merger announcement on the target firm’s shares occurs *before* the public announcement of a tender offer. Keown & Pinkerton, *supra* note 73, at 866. Their suggestion, however, that most of this pre-announcement price effect results from pure leakage alone, *id.* at 863-66, may well slight the derivatively informed trading mechanism by neglecting indirect forms of information leakage. See *infra* text accompanying notes 78-95.

⁷⁷ We owe this latter term to Robert Verrecchia. See Verrecchia, *Consensus Beliefs, Information Acquisition, and Market Information Efficiency*, 70 Am. Econ. Rev. 874, 881 n.12 (1980).

⁷⁸ Scholes, *supra* note 67. “Secondary distributions” are underwritten, block sales made off the stock exchanges at a subscription price. *Id.* at 184-85. Since secondary distributions are mediated by underwriters and are usually unregistered with the SEC, neither the subscription buyers nor the market ordinarily learns of the identity of the vendors until after the sales are complete. *Id.* at 201-02.

vestment gain.⁷⁹ The clear implication is that uninformed traders use the identities of large sellers to deduce whether the latter are likely to possess valuable information, and then proceed to trade accordingly.⁸⁰ Moreover, incidental evidence suggests that trade decoding is pervasive well beyond the limited context of block trades.⁸¹ Indeed, the Federal Securities Acts themselves provide prime opportunities for trade decoding by the uninformed by forcing insiders and other informationally-advantaged traders to disclose their activities, if not their motives.⁸²

Pervasive though it may be, however, trade decoding remains limited by a significant constraint: uninformed traders must be able to identify informed traders individually and observe their trading activities directly. By contrast, the second form of indirect leakage, price decoding, does not require uninformed traders to

⁷⁹ Id. at 200-04. As might be expected, Scholes also reports that the minority of registered secondary offerings whose vendors *were* known prior to the date of sale exhibited no abnormal price movement following the sale. Id. at 204-06.

⁸⁰ Id. at 202. The absence of any relationship between distribution size and the magnitude of longterm price change further supports a trade-decoding interpretation of Scholes' findings. Id. at 207. For discussion of temporary price pressure effects and their significance for the derivatively informed mechanism, see *supra* note 67; *infra* text accompanying note 128.

⁸¹ Brokers are particularly well-placed to engage in trade-decoding. Consider the ease with which employees of E.F. Hutton & Company detected trading on inside tender-offer information by a partner in a major Wall Street law firm: "employees at Hutton are understood to have noticed a pattern in [the partner's] account where, as one source put it, 'He got too lucky . . .'" Cole, *Wachtell Lawyer is Out in Insider-Trading Case*, N.Y. Times, Sept. 12, 1981, at D29, col. 1, at D36, col. 3. However, not only brokers but the entire market expects to learn from the activity of informed traders. The Advisory Committee Report, *supra* note 3, notes that 47% of surveyed individual investors regarded the trading activity of presumptively savvy institutions to be "important" trading information. Id. at 286. For this reason, trade decoding, like any other information channel, can be manipulated to deceive rather than inform. According to a well known (but apocryphal) story, the House of Rothschild reaped a fortune by giving a public sell order after the Battle of Waterloo, thereby leading London Exchange traders to believe that Rothschild had early knowledge of a British loss when, in fact, Rothschild knew of the British victory. Rothschild then profited handsomely, the story goes, by trading against a market it knew to be wrong. Kantor, *supra* note 42, at 1431 n.4.

⁸² E.g., § 13(d) of the Securities Exchange Act of 1934, 15 U.S.C. § 78m(d) (1982) (requiring reporting, within 10 days, of boilerplate information regarding the purchase of any security that gives the owner more than 5 percent of that class of security); § 16(a) of the 1934 Act, 15 U.S.C. § 78p (1982) (requiring directors, officers, and 10% beneficial owners to report purchases and subsequent changes in ownership of issuer's equity securities within 10 days after initial acquisition and 10 days "after the close of each calendar month thereafter").

discover the identity of their informed cohorts. It merely requires uninformed traders to observe and interpret anonymous data on price and trading volume against the backdrop of other information or expectations that these traders possess.

In theory, at least, the logic of price decoding is simple. When trading on inside information is of sufficient volume to cause a change in price, this otherwise inexplicable change may itself signal the presence of new information to the uninformed. Why, after all, would anyone persistently trade against the market *unless* they possessed such information?⁸³ But beyond the "weak" learning involved in identifying the presence of new information, uninformed traders may also succeed in decoding the actual content of the information.⁸⁴ The trick here, and admittedly it is no mean feat, is the uninformed trader's ability to employ knowledge of the informational constituents of the old price to deduce which possible accretion of new information would successfully explain observed price changes.⁸⁵ Yet, probabilistically, such "strong" learning may

⁸³ But see *infra* note 89 (manipulation through deceptive price signals).

⁸⁴ What we term "weak" learning from price, then, does *not* involve the active extraction of information from price, but only the more modest recognition that unanticipated price changes may signal the *existence* of new information. This reflects the "rational expectation" that other traders, like oneself, buy or sell securities on the basis of their expected returns. If market prices change unexpectedly, the reason must be that other traders have acquired new facts or forecasts that alter their assessments of expected returns. Weak learning in this sense is the first step of price decoding, and may also accompany professionally informed trading, see *supra* note 67, and the uninformed trading mechanism, *infra* text accompanying notes 116-21. By contrast, full price decoding, which is specific to the derivatively informed mechanism, involves "strong" learning from price. Significant numbers of traders transmit actual information through price and volume signals.

⁸⁵ Thus, unlike screening rules or other attempts to discover trading opportunities in price data alone, price decoding relies principally on the interaction *between* price changes and independent information about firms. The more widespread this independent information is among traders, of course, the more widely distributed correct deductions from price changes will be, and the less likely it is that price decoding will yield trading profits. But if incipient price changes can only be interpreted by a few traders who have already acquired detailed knowledge about the firm, or if unexpected price changes lead a handful of traders to research the firm, these price changes may well yield trading profits.

Since the mid-1970's, economists employing the conditional forecasting methodology associated with the "rational expectations" literature have developed a family of models specifying the sufficient conditions for, and the implications of, price decoding in a variety of simple markets. See, e.g., Grossman, *On the Efficiency of Competitive Stock Markets Where Trades have Diverse Information*, 31 J. Fin. 573 (1976); Kihlstrom & Mirman, *Information and Market Equilibrium*, 6 Bell J. Econ. 357 (1975). See also Hirschleifer & Riley, *supra* note 39, at 1411-14 (reviewing forecasting methodology). S. Sheffrin, *supra* note 10, at 115-24, provides a highly readable overview that relates these models both to the broader ra-

be less difficult than it at first appears; consider, for example, how frequently increases in price signal the presence of inside information about impending tender offers.⁸⁶

The theory of "weak" learning from prices is standard economic fare, traditionally linked with the contributions of Friedrich Hayek.⁸⁷ Attempts to model "strong" learning, however, are comparatively recent and are still in a developmental stage in which they must radically simplify the learning processes of real markets.⁸⁸ Nevertheless, they not only provide the best available account of this commonplace market phenomenon,⁸⁹ but they also

tional expectations literature and to contemporary finance theory (itself a variant of the rational expectations approach).

⁸⁶ See Keown & Pinkerton, *supra* note 73, who report not only accelerating price increases during the three weeks that precede tender offers, but also

that 79, 60, and 64 percent of the acquired firms exhibited higher volume one, two, and three weeks prior to the announcement date than they had three months earlier with the weekly average volume over this three week period 247, 112, and 102 percent higher than it was three months earlier.

Id. at 863.

It is impossible to determine how much such crescendos of trading activity owe to pure leakage, trade decoding, or price decoding, respectively. The very strength of the incipient price and volume changes, however, suggests that "strong" price decoding plays a major role, especially as the other forms of informational leakage amplify the strength of the price signals.

⁸⁷ See Hayek, *The Use of Knowledge in Society*, 35 *Am. Econ. Rev.* 519, 526-28 (1945).

⁸⁸ On the use of simplifying assumptions, see, e.g., Grossman & Stiglitz, *On the Impossibility of Informationally Efficient Markets*, 70 *Am. Econ. Rev.* 393, 395 (1980) (proving conjectures regarding non-existence of fully-informative prices under simplified assumptions); Radner, *Rational Expectations Equilibrium: Generic Existence and the Information Revealed by Prices*, 47 *Econometrica* 655 (1979) (proving likelihood of fully-informative prices under assumption of finite information states). Some scholars have criticized Radner, Grossman & Stiglitz, and other rational expectations "micro-theorists" for relying on implausible, regression-like accounts of individual forecasting. See, e.g., Frydman, *Towards an Understanding of Market Processes: Individual Expectations, Learning, and Convergence to Rational Expectations Equilibrium*, 72 *Am. Econ. Rev.* 652, 664-65 (1982). In our view, however, neither the complexity of real markets, nor the difficulties of providing a wholly satisfactory theoretical account of individual forecasting behavior, diminish the central insights of the price-decoding theorists, which we address *infra* text accompanying notes 103-23, and in Section IV.

⁸⁹ The history of market manipulation is replete with persuasive, if back-handed, evidence of trader reliance on price decoding. To the extent that such venerable scams as "wash sales" and "matched orders" trick uninformed traders into bidding up share prices through misleading price and volume data, they succeed for precisely the same reason that stock touting succeeds: namely, they transmit misinformation through a usually reliable information channel. See Kryzanowski, *Comment: Misinformation and Security Markets*, 24 *McGill L.J.* 123, 124-26 (1978). Indeed, the fact that such deceptions can create "manipulation bubbles" of considerable duration (1-12 months) on thinly-traded exchanges, *id.* at 130-

raise a question that cuts to the core of efficient market theory. Why would anyone incur the cost and risk of acquiring restricted-access information, if hair-triggered "decoders" will extract the bulk of its value? The answer must be that prices are not fully informative and, indeed, that the acquisition effort is made precisely because they are not. As Grossman and Stiglitz⁹⁰ recently demonstrated, a market in which price decoding was both costless and accurate could not support an efficient equilibrium in which prices fully reflect trading information. Rather, such a market would be doomed to an oscillating dynamic of enlightenment and ignorance. Traders would initially acquire information because, in an inefficient market, they could earn returns on their investment in acquisition. As more traders became initially informed, however, the price system would convey more information to uninformed traders, thereby lowering the returns to informed traders. At the point at which the market became fully efficient, there would be no return to informed traders for having acquired the information, and, as a result, information acquisition would cease. The market would sink into informational inefficiency once more, only to repeat the cycle as soon as some traders again found information ac-

31, suggests not only the extent of investor reliance on price information but also a link between price decoding and the volatility of securities prices generally. See also Kryzanowski, *Misinformation and Regulatory Actions in the Canadian Capital Markets: Some Empirical Evidence*, 9 *Bell J. Econ.* 355, 365 (1978) (although regulatory intervention deflates manipulative bubbles, price deflation is gradual). Recent investigations of the volatility of exchange prices, as contrasted with the relative price stability of shares traded while the exchanges are closed, also suggest the importance of price and trade decoding. See K. French & R. Roll, *Is Trading Self-Generating?* (Feb. 1984) (Working Paper No.121, Center for Research on Securities Prices, University of Chicago Graduate School of Business).

Of course, evidence of "strong" learning from price is always difficult to separate from pure leakage or trade-decoding on the one hand, and "weak" learning from price on the other. For example, Garbade, Pomrenze, & Silber report that dealers in Government National Mortgage Association securities periodically revise their bid and ask prices in light of average price quotes of other dealers, although such revision is never total and depends on the dispersion of other dealer prices. The greater the dispersion, the lower the apparent quality of information in price. Garbade, Pomrenze, & Silber, *On the Information Content of Prices*, 69 *Am. Econ. Rev.* 50 (1979). These results are impressive testimony to the information content of prices. Yet they do not specifically distinguish between price decoding—a dealer's inference from average price that he has underestimated public demand—and the inchoate weak expectation that price itself can signal unknown but relevant information.

⁹⁰ Grossman & Stiglitz, *supra* note 88; Grossman & Stiglitz, *Information and Competitive Price Systems*, 66 *Am. Econ. Rev.* 246, 250-51 (1976). See also Grossman, *supra* note 85; S. Sheffrin, *supra* note 10, at 122 (non-technical account of Grossman & Stiglitz model).

quisition profitable.⁹¹

Perhaps it is fortunate, then, that fully-effective price decoding remains a theoretical concept rather than a market reality. It is only because uninformed traders cannot infer *all* information from price—i.e., because prices are “noisy”—that informed traders enjoy a return on their information up to the point at which further trading moves prices beyond the noise threshold.⁹² Thus, the reflection of non-public information into price is a two-stage process; it is first triggered by initially informed “inside” trading, but, at a critical threshold, it rapidly accelerates as a result of reactive trades. This much ensures that price reflects each “bit” of decoded information with a moderate degree of relative efficiency—less, to be sure, than a wider initial distribution might provide, but far more than the trades of initially informed investors alone could produce.⁹³ For the price system as a whole, background noise implies an “equilibrium degree of disequilibrium.”⁹⁴ Noise levels regulate the numbers of informed traders much like returns on initially informed trading regulate entry into the community of market professionals in the context of professionally informed trading. The number of informed traders, in turn, determines the volume of limited-access information that influences prices at any particular moment, and the end result is perpetual, if constrained, disequilibrium.

In short, derivatively informed trading, whether it operates through trade- or price-decoding, is self-limiting. It guarantees neither full efficiency nor inefficiency, but rather a level of relative

⁹¹ Grossman & Stiglitz, *supra* note 88, at 404.

⁹² *Id.* In the simplified Grossman & Stiglitz model, “noise” takes the form of uncertainty in the per capita supply of a single risky asset. *Id.* at 396. This single, exogenous noise source is a standard feature of “noisy” learning models, which, owing to their necessarily simple internal structures, otherwise threaten to make price too revealing to be empirically plausible. See Diamond & Verrecchia, *Information Aggregation in a Noisy Rational Expectations Economy*, 9 *J. Fin. Econ.* 221, 222, 233-34 (1981). For discussion of a more intuitive operational notion of noise, see *infra* note 120.

⁹³ See *supra* note 67. The concomitant risks of price decoding are, of course, the danger that price change may communicate misinformation, see *supra* note 89, or that it may be incorrectly interpreted. These risks, which inhibit price decoding, are likely to be greater than the analogous misinformation risks associated with pure leakage and trade decoding, if only because the latter are intrinsically richer information channels. Thus, price decoding may typically work in tandem with these other models of derivatively informed trading, even when price signals are wrong.

⁹⁴ Grossman & Stiglitz, *supra* note 88, at 393.

efficiency that is jointly determined by the effort required to acquire information and the decoding possibilities that limit its exploitation.⁹⁵ Derivatively informed trading thus explains how prices can come to reflect much information that is truly "non-public," even while suggesting the inevitable limits to the process.

D. Uninformed Trading

The three trading mechanisms that we have considered thus far each describe processes by which prices come to reflect particular key trading facts. Such pieces of information have strong and straightforward implications for price. As we emphasized in Section I, however, information is not limited to hard facts; it also includes soft information, the stuff of forecasts and predictions, that is at least as critical to trading as key trading facts. Both in developing forecasts of future events and in making a master forecast of value, traders employ, in addition to key facts, a wide variety of secondary facts, differing beliefs, and diverse levels of predictive skills.⁹⁶ This heterogeneity of information, beliefs, and skills adds additional uncertainty to that stemming from the inherent indeterminacy of the future.⁹⁷ The uncertainty arises from the

⁹⁵ Verrecchia has recently modeled the interaction between the information acquisition activity of traders and "weak" learning from price as a summary of aggregate trader information. Verrecchia, *Information Acquisition in a Noisy Rational Expectations Economy*, 50 *Econometrica* 1415 (1982). See *infra* note 120 (summarizing Verrecchia's conclusions).

⁹⁶ See *supra* text accompanying notes 41-42 (fact-forecast dichotomy). That the fact-forecast dichotomy is in some respects a simplification of the structure of information is apparent from the reference to "key" trading facts. Key facts such as earnings figures, dividend payments, major business decisions, and reports of likely fraud, dominate trader information sets with strong, unproblematic implications for price. Secondary facts, which imply marginal or contingent adjustments in expected value, are among the raw materials of "soft" forecasts; they have compelling significance for trader expectations only in the aggregate. An example of a secondary fact would be evidence of an issuer's product performance in one of many local markets. Finally, certain third party forecasts themselves can assume the status of key trading facts when they reflect secondary facts and judgments that are otherwise unavailable to the market. An example would be an earnings projection by an issuer.

⁹⁷ Facts may also be uncertain because of unreliable reporting or the difficulty of verification. See *supra* text accompanying notes 44-48. Conceptually, this risk parallels the uncertainty introduced into forecasting by an incomplete set of secondary facts or the lack of processing skills. The difference lies in the comparative ease with which many facts can be verified as virtual certainties. See *infra* text accompanying notes 136-42.

For this purpose, we intend the "future" to include events that have already occurred but that have not yet been disclosed to traders. For example, traders routinely predict the content of future public announcements about Federal Reserve decisions that have already

sheer impossibility of acquiring both the full range of secondary facts and the complete repertoire of skills necessary to frame optimal forecasts. To return to a concept used earlier,⁹⁸ a hypothetical fully informed trader would form optimal forecasts as a result of access to the aggregate information, beliefs, and skills of *all* traders in the market, but individual traders would remain ignorant of this optimal forecast information. Such information is "available" to the market, but it nonetheless lies at the extreme pole of the continuum depicting the initial distribution of information to traders. In extreme contrast to the virtually complete distribution of information that underlies universally informed trading,⁹⁹ optimal forecast information is not available to any *individual* trader. At this juncture, the basic question of market efficiency resurfaces. What is the mechanism by which the market comes to reflect the diverse and imperfect forecasts of individual traders into the aggregate forecast of price, and how well does this mechanism function as measured against the yardstick of optimal forecast data?

The final market efficiency mechanism, uninformed trading, permits prices, in some circumstances, to reflect aggregate—or consensus—forecasts that are more nearly optimal over the long run than those of any individual trader. In this sense, prices can reflect information about which *all* traders are uninformed.¹⁰⁰ For expository purposes, it is useful first to develop the uninformed trading mechanism in its simplest form, as a pure, "naive"¹⁰¹ aggregation of information in price that occurs *before* traders discover the value of price as a forecasting statistic.¹⁰²

been made. See *supra* note 59.

⁹⁸ See *supra* text accompanying note 41 ("fully informed trader").

⁹⁹ See *supra* text accompanying notes 58-60.

¹⁰⁰ Note, however, that uninformed trading *never* leads to prices that reflect wholly optimal forecast data. See *infra* text accompanying notes 105-06. Rather, this mechanism can lead to prices that reflect a *better approximation*, over the long run, of such hypothetical optimal forecasts than can the parallel assessments made by individual traders. For this reason, the uninformed trading mechanism has the lowest relative efficiency of any of the four market mechanisms. As measured against the yardstick of the target information—i.e., optimal forecast data—it can never assure fully informed prices, even though it may reflect consensus forecasts in price much more rapidly than, say, derivatively informed trading will reflect inside information in price.

¹⁰¹ Cf. S. Sheffrin, *supra* note 10, at 119-20 (defining "naive" price equilibrium for traders with diverse information).

¹⁰² In actual markets, of course, traders are aware of the potential value of price as a summary indicator of other traders' information. See *infra* text accompanying notes 114-15.

If each trader's forecast about the likelihood of a future event is informed in part by secondary facts and evaluations to which only he has access, then an aggregation of all forecasts draws on an information pool much larger than that possessed by any individual trader. Although each trader's own forecasts are skewed by the unique constraints on his or her judgment, other traders will have offsetting constraints. As trading proceeds, the random biases of individual forecasts will cancel one another out, leaving price to reflect a single, best-informed aggregate forecast. Uninformed trading, then, resembles a regression in which the dependent variable is price, the independent variables are the "bits" of information bearing on an unbiased forecast, and the weights attached to each bit are determined by the buy-sell decisions of individual traders. Although individual traders will attach biased weights because each knows only a fraction of the relevant information, the cumulative weights will be unbiased unless trading volume is itself skewed toward the views of one set of uninformed traders. In this respect, unsystematic bias "washes out" over trading in the same way that unsystematic risk "washes out" in a diversified portfolio.¹⁰³ Moreover, if any bias persists, it does so because the "errors"

We have previously referred to this knowledge as "weak" learning from price, see *supra* note 84 and text accompanying note 87, in order to distinguish it from the "strong" learning of price decoding, which envisions that traders deduce the actual content of information. The presence of weak learning in the context of uninformed trading, which is discussed *infra* text accompanying notes 103-23, illustrates once again the blurring of boundaries among the market efficiency mechanisms that persuades us that they are aspects of a single, complex whole.

¹⁰³ The role of price in the uninformed trading mechanism resembles the role of consensus forecast in polls of expert opinion. Such forecasts will tend to demonstrate greater predictive accuracy whenever individual experts have roughly equal access to diverse information or technical skills. See, e.g., W. Beaver, *supra* note 38, at 160-62 (over three year period, consensus forecast of winning football teams outperformed forecasts of individual sports reporters which made up the consensus forecast); Malabre, *If One Economist Goofs, Will 46 Do Any Better?: Robert Eggert Thinks So, and He May Be Right*, *Wall St. J.*, Apr. 6, 1983, at 53, col. 1 (expanding demand for consensus forecasts dictated by growing sense that "while rarely exactly right, [they] are less likely than individual forecasts to go horribly wrong"). And while consensus forecasts are clearly less useful when their constituent estimates are systematically biased, see *infra* note 107, even the effects of bias may be minimized with appropriate weighting strategems. S. Sheffrin, *supra* note 10, at 116-17. Since systematic bias is likely to afflict all actual markets to some degree, the empirical weights fixed by ongoing trading may critically affect the efficiency of uninformed trading. See *infra* note 110. Whatever these effects, however, the information aggregation function of price is a significant source of market efficiency that conventional economic theory has long neglected. S. Sheffrin, *supra* note 10, at 117.

of individual traders are perversely correlated, just as unsystematic risks might be in a poorly diversified portfolio.¹⁰⁴

Robert Verrecchia¹⁰⁵ has modeled the conditions under which the regression-like behavior of uninformed trading aggregates all forecast information available to the market—but not to all individual traders—into a consensus best estimate of value. Of course, real markets at best can only approximate these conditions, but the interesting issue here, as with the other market mechanisms, is the identification of the factors that determine when and how well uninformed trading operates. Verrecchia's model requires traders to make independent assessments of the value of risky securities based on their own facts and forecasts, which in the aggregate form a bounded, unbiased distribution around the hypothetical price that a fully informed trader would assign the security.¹⁰⁶ The first of these conditions, that trader assessments be independent, requires an absence of collusion, "learning," or shared prejudice among traders that would render individual forecasting errors mutually reinforcing.¹⁰⁷ Complete independence, of course, is unlikely in real markets, but so is widespread mutual dependence where it contradicts the independent judgments of many traders. No one

¹⁰⁴ Any widespread mistake, forecasting error, or breakdown in the acquisition of key facts can generate bias with respect to the "true" distribution of probabilities associated with contingent outcomes. For example, widespread, if unjustified, optimism about the virtues of conglomeration represents an apparently common form of trader bias in poorly informed markets. The existence of forecasting bias, however, does not necessarily indicate that individual traders are acting irrationally. Forecasting methods that were accurate in the past, including reliance on the information content of price, may prove inadequate in light of altered circumstances. See *infra* text accompanying notes 112-13 (bias created by injection of new trading fact).

¹⁰⁵ Verrecchia, *supra* note 13. See Verrecchia, *supra* note 77 (alternative formulation of simple aggregation). Still more recent aggregation models by Verrecchia explore markets in which traders learn aggregate forecasts in part from price. Diamond & Verrecchia, *supra* note 92; Verrecchia, *supra* note 95. For discussion, see *infra* text accompanying notes 114-23.

¹⁰⁶ Verrecchia, *supra* note 13, at 88.

¹⁰⁷ Widespread trade or price decoding would violate the independence condition. One would not expect high volume derivatively informed trading, however, in the absence of new key trading facts. Such facts would, in any event, render aggregate forecasts obsolete. Better examples of assessment bias might be the expectations induced by market "gurus." See, e.g., Putka, *Stocks' Record-Breaking '82 Rally Hid a Multitude of Market Flaws*, *Wall St. J.*, Jan. 3, 1983, at 5, col. 4 (pronouncements of Saloman Brothers' "guru" Henry Kaufman triggered sustained 1982 market rally). Note, however, that if traders condition their beliefs on *both* price and their own independent assessments—i.e., engage in "weak" learning but not price decoding—the independence condition is not violated. Verrecchia, *supra* note 13, at 88. But see *infra* note 119.

ever earned money in the market, after all, by consciously discounting his or her personal knowledge without good reason. The second condition of uninformed trading, that trader assessments be "bounded," merely requires that all such assessments fall in the same ball park.¹⁰⁸ Traders with wildly-skewed personal assessments will impede price convergence—reduce the relative efficiency of the uninformed trading mechanism—and may even preclude it entirely in thinly-traded markets.¹⁰⁹ Again, however, market discipline in the form of heavy trading losses will restrain idiosyncratic traders and may even eliminate them through a "Darwinian" process of natural selection.¹¹⁰

¹⁰⁸ Verrecchia, *supra* note 13, at 82.

¹⁰⁹ The analogy for purposes of our regression metaphor, see *supra* text accompanying note 103, is wildly skewed "outliers" in data sets. These outliers can have a dramatic and often unwarranted effect on the predicted magnitude and variance of the dependent variable (here market price), especially when the data set is small. Precisely because of this effect, Verrecchia suggests that smaller firms with fewer shareholders will have a comparatively greater incentive to release information and reduce the dispersion of trader forecasts that might otherwise lead to skewed share prices. Verrecchia, *supra* note 13, at 89-90. Since markets are more complex than the regression metaphor would suggest, factors other than the "outlier effect" also affect the quality of price as an information-aggregating statistic. As Verrecchia has recently noted, one such factor is risk preference. The quality of consensus forecasts will increase if risk-tolerant traders make better forecasts than their risk-avoiding counterparts. Verrecchia argues that they are likely to do so. Verrecchia, *supra* note 77, at 878-79. Employing a similar methodology, Figlewski observes that equilibrium prices will better aggregate trader information where all traders are relatively risk-averse, and where they resemble one another in key respects bearing on the magnitude of individual trades. Such factors include individual wealth, forecasting skills, and the level of risk preference. Figlewski, *supra* note 13, at 594-96. As in the case of the "outlier effect," these observations generally confirm the importance of according each trader's independent assessment full weight in price.

¹¹⁰ Verrecchia, *supra* note 13, at 82. Cootner provides the classic early discussion of "natural selection" (or wealth redistribution) and how it contributes to the uninformed trading mechanism:

Given the uncertainty of the real world, many actual and virtual investors . . . will have many, perhaps equally many, price forecasts . . . If any group of investors was consistently better than average in forecasting stock price, they would accumulate wealth and give their forecasts greater and greater weight . . . Conversely, investors who were worse than average in forecasting ability would carry less and less weight. P. Cootner, *The Random Character of Stock Market Prices* 80 (1964). Figlewski, however, notes a constraint on Darwinian selection that may render this process self-limiting. As long as all traders forecast on the basis of *some* relevant information that would not otherwise register in price, they need not be driven from the market entirely no matter how poorly they compare to more astute or informed traders. In a process recalling the Grossman and Stiglitz "Efficiency Paradox," see *supra* text accompanying notes 90-91, trading activity will transfer wealth from bad to good forecasters until, on average, the independent informational contributions of even poor forecasters will earn a positive return. This is true because,

It is the third condition of uninformed trading, that aggregate trader assessments remain unbiased with respect to the optimal price estimate of a fully informed trader, that may be the most demanding. This condition embraces the preceding two requirements, since either widely-shared forecasting errors or idiosyncratic trading can bias the aggregate-level distribution of trader assessments. But, in addition, the "no-bias" condition carries implications for the acquisition of new key trading facts that can significantly alter individual assessments. Until the market fully incorporates such key information into price, the independent assessments of uninformed traders—traders who do not know of the new information—are inevitably systematically biased. Once *any* trader acquires a new key fact that renders hitherto uncertain contingencies more (or less) likely, the consensus forecast of uninformed traders, as embodied in existing price, is biased relative to the newly-available information. Moreover, it remains so until the market fully incorporates the new key information into price, through one of the three "informed" trading mechanisms previously described.

This complementary relationship among the market mechanisms can be viewed either from the perspective of uninformed trading or from that of the three informed trading mechanisms. When viewed from the perspective of uninformed trading, the informed market mechanisms are "shortcuts" to the elimination of sudden informational bias in consensus prices. They rely on the speedy transmission of information to traders rather than on the much slower and less certain process of market discipline.¹¹¹ By contrast, when uninformed trading is viewed from the perspective of the three in-

if such contributions are genuinely independent, they will possess some predictive utility that even the most astute traders cannot match. Figlewski, *supra* note 13, at 591-92. See also Figlewski, *supra* note 41, at 99-100. Of course, this assurance of a market niche for poor forecasters is a "defect" of uninformed trading only from the demanding perspective of a fully informed trader. From the vantage point of mere mortals, it contributes to the aggregate information content of price.

¹¹¹ See *supra* note 110 (market discipline). Moreover, the informed trading mechanisms ensure that the bulk of trading information is shared by all traders. A large percentage of traders receive the diverse residual information, consisting of forecasts and secondary facts, in comparable if not exactly equal endowments. This enhances the quality of consensus forecasts. See *supra* note 103 (consensus expert forecasts depend on equal access to diverse information). Since neither professionally informed nor derivatively informed trading literally transmits information to every trader, however, the process also depends on universal "weak" learning from price. See *supra* note 84; *infra* text accompanying notes 115-19.

formed market mechanisms, it represents an interstitial mechanism that operates between the appearances of new key trading facts. Uninformed trading "fine-tunes" equilibrium price and assures that price registers any gradually developing consensus about future contingencies.

The example of a truly innovative investment contract, such as a radically novel form of bond indenture, further illustrates the complementary nature of the market mechanisms. When an issuer first announces such an innovative security, all traders will be uncertain about its worth. Although the issuer may make good-faith representations about value, most traders will discount these as self-interested puffery.¹¹² Absent convincing assurances, the initial pricing of the innovative security will be left to the uninformed trading mechanism, which will tend to "undervalue" it relative to the information possessed by the good-faith issuer—but not, of course, relative to the aggregate forecasts of the uninformed traders. Thus, the security's uninformed equilibrium price will be "biased," and relatively inefficient. Efficiency is possible only if the issuer succeeds in making its representations credible, or if an enterprising trader independently acquires the key facts that establish their accuracy.¹¹³ In the first case, subsequent price equilibration would proceed rapidly through the universally informed or professionally informed trading mechanisms; in the second, it would proceed more slowly through derivatively informed trading.

Yet this depiction of the relationship between uninformed and informed trading mechanisms still remains incomplete in one important respect: it ignores the fact that traders themselves are acute observers of market behavior. If prices successfully aggregate all available information, including consensus forecasts and secondary facts, traders will begin to condition their trading activity on price as well as on their individual assessments of value.¹¹⁴ This

¹¹² The example of the innovative bond indenture together with the kind of assurances that issuers can offer traders is analyzed in detail in Section III, *infra* text accompanying notes 153-63.

¹¹³ The good faith issuer, of course, offers an accurate appraisal of the innovation's value. If such an appraisal can result only from detailed study, "outside" traders may not find replication of the study worth their while. See *infra* text accompanying note 132.

¹¹⁴ Diamond & Verrecchia, *supra* note 92, at 222 (simple price aggregation models are "subject to the objection that when prices do contain information that a particular trader does not possess he ought to make use of it"). See also Garbade, Pomrenze & Silber, *supra* note 89 (study of GNMA dealer price revision in light of independent assessments and aver-

conditioning on price adds "learning" to the basic aggregation mechanism of uninformed trading and is precisely the "weak learning" from price that we previously contrasted with the "strong learning" of price decoding.¹¹⁵ Weak learning in this sense occupies a middle ground between uninformed and derivatively informed trading.¹¹⁶ Unlike price decoding, which transmits key trading facts, weak learning conveys refracted data about consensus opinion that is already fully impounded in price and has comparatively little potential for revising individual traders' facts and forecasts. In many instances, the simple aggregation process of uninformed trading will obscure the sources of weak or gradual price changes and so preclude any deduction about their meaning other than the obvious one—that a shift has occurred in consensus market expectations.¹¹⁷ But even where traders are able to associate price and volume signals with shifts in *particular* aggregate forecasts, such as an altered consensus forecast about future Federal Reserve Board policies, they will only acquire an indication of whether the market disagrees with them, not of why it does. The force of such an indication depends on each trader's level of confidence. Individual estimates of value will move toward existing prices, and individual forecasts toward consensus predictions, in rough proportion to how highly each trader assesses the comparative quality of his or her own collection of information.

The existence of weak learning from price¹¹⁸ itself indicates that,

age price quotes).

¹¹⁵ See *supra* text accompanying notes 84-88; *supra* notes 84, 89 & 102.

¹¹⁶ In the recent history of efforts to model market mechanisms, uninformed trading accompanied by "weak learning" from price finds its place in the conjunction of price aggregation models and the rational expectations literature. See *supra* note 85. The leading examples include Diamond & Verrecchia, *supra* note 92; Figlewski, *supra* note 41; Hellwig, *On the Aggregation of Information in Competitive Markets*, 22 *J. Econ. Theory* 477 (1980); Verrecchia, *supra* note 95. Although most of these models are presented as descriptively superior to the rational expectations models in which price *transmits* diverse information without first aggregating it, see, e.g., Grossman, *supra* note 85, in our analysis both families of models capture real but distinct market processes: namely, uninformed trading with learning and price decoding, respectively. See, e.g., Diamond & Verrecchia, *supra* note 92, at 221-23 (questioning realism of information transmission models). See also *supra* note 85 (rational expectations models defined). The fact that these disparate processes may sometimes occur simultaneously within different groups of traders, such as where sophisticated traders forge ahead with price decoding and lay traders lag behind with weak learning, need not blur the central distinction between them.

¹¹⁷ Diamond & Verrecchia, *supra* note 92, at 232-33.

¹¹⁸ See *supra* notes 84 & 87.

on average, such learning improves the quality of individual trading decisions. To the extent that it succeeds, it will also have a beneficial "feedback" effect on the core aggregation processes of uninformed trading by decreasing unwarranted dispersion in individual assessments of value.¹¹⁹ The amount and importance of weak learning that occurs, however, are also constrained by the level of price noise—the same random fluctuation in price that masks the transmission of key trading facts through price decoding. Price noise, then, regardless of its source,¹²⁰ establishes the

¹¹⁹ If traders rely on price in roughly inverse proportion to the quality of their independent assessments, the most poorly informed traders will rely most on price, thereby reducing the number of wildly skewed "outlier" trades. See *supra* note 109. In this sense, weak learning from price can function as a short-cut to the elimination of bias, just as do the informed trading mechanisms. See *supra* text accompanying note 111. On the other hand, weak learning can also generate inefficiency in uninformed trading by amplifying any systematic bias reflected in price. Weak learning cannot *create* biased prices, see *supra* note 107, but if the forecasts of confident investors who trade heavily on their independent assessment are already biased, weak learning by less confident traders may transmit the bias and "freeze" it into price. This phenomenon parallels the transmission of misinformation through price decoding. See *supra* note 89. In all likelihood, schemes to defraud investors through "churning" and "matched orders," *id.*, depend on the joint operation of both price decoding and weak learning. Similarly, weak learning is likely to augment any "natural" misinformation transmitted by price decoding and so contribute to the overall volatility of share prices. *Id.* The persistence of weak learning despite these inefficiencies, however, indicates its net positive contributions to the informational quality of trades, and thus to the quality of consensus information reflected in price.

¹²⁰ Considerations of simplicity and theoretical consistency have led economists to treat noise as random price fluctuation generated by supply-related factors outside the market. See Diamond & Verrecchia, *supra* note 92, at 233-34 (tax and life-cycle motivated trades as sources of price noise); *supra* note 92 (noise from variation in supply of risky assets). For descriptive purposes, however, it is more useful to define "noise" operationally as *all* seemingly random fluctuations in price that interfere with price decoding and weak learning. By definition, then, "noise" measures the extent to which the prices generated by uninformed trading subsequently prove to be imperfect indicators of future returns. Certainly this definition includes any supply-related stochastic price fluctuation. But see *supra* note 67 (supply and demand effects on individual securities prices likely to be modest). Yet it also embraces the effects of all residual uncertainties affecting price, including the inherent uncertainty of future events; the limits on total information available to traders; the relative inefficiencies of the market mechanisms, including any systematic bias in uninformed trading; and the intrinsic difficulties of predicting returns partly on the basis of price. See Figlewski, *supra* note 41, at 100-01; Frydman, *supra* note 88. Such a global concept of noise highlights the interrelationship between the informativeness of prices and other market variables, including the total amount of information acquired by traders and the relative efficiency of the market mechanisms. Verrecchia, however, has recently employed the narrower concept of an exogenously-fixed source of noise to model the informativeness of price in relation to several important market variables. Verrecchia, *supra* note 95. His analysis suggests that where price aggregates rather than simply transmits information, prices reveal

limits on the ultimate efficiency of uninformed trading.¹²¹ On the other hand, the instances in which the market has "guessed" right are an index of the success of uninformed trading. The paradigmatic examples are the many occasions on which publication of Federal Reserve Board policy decisions, fluctuations in money supply, and similar data of interest to investors have resulted in no discernable effect on prices.¹²² Not surprisingly, these examples differ from the case of the novel innovative security in that they concern future events about which all traders are likely to possess well-specified, reasonably exact forecasts.¹²³

In sum, the formulation of expectations in response to uncertainty will always constitute a major portion of the task of valuing securities. Over much of this domain, the uninformed trading mechanism will bear the burden of reflecting these expectations in price.

E. Summary

The uninformed trading mechanism completes the array of capital market mechanisms that, in our view, constitutes an essential element of efficient market theory. For any initial distribution of information in the market, including an initial distribution to no one in the case of optimal aggregate forecasts, one or more efficiency mechanisms facilitate the eventual "reflection" of informa-

an increasing proportion of the trading content of available information as noise levels, information costs, or group risk aversion decreases. *Id.* at 1427-28. In the case of reduced noise levels, moreover, prices become more informative *even though* they aggregate less total information, since the very ease with which they reveal information also lowers trader incentives to acquire it. *Id.* Cf. *supra* text accompanying notes 90-91 (contrasting "efficiency paradox" outcome of strong learning models).

¹²¹ Stated differently, it limits the extent to which price can converge to a single best estimate that reflects not only key trading facts, but also optimal forecasts of all residual uncertainties affecting a security's value.

¹²² See, e.g., Waud, *supra* note 59, at 248-49 (Federal Reserve discount rate decisions). By way of contrast, Diamond and Verrecchia, *supra* note 92, point to one obvious instance in which uninformed trading fails to aggregate trader information fully, namely, the significant announcement effect that follows publication of the consumer price index, all of whose components are known to traders in the aggregate. *Id.* at 233. See Schwert, *The Adjustment of Stock Prices to Information About Inflation*, 36 J. Fin. 15, 27-28 (1981).

¹²³ Market experience with routine forms of new information establishes a range of possible price effects. But even this bounded range of possible outcomes will be hazy in the case of novel events. See F. Knight, *supra* note 42, at 233 (distinguishing between "risk" and "uncertainty").

tion into price.¹²⁴ Moreover, the four efficiency mechanisms are complementary; each functions over a characteristic segment of the continuum of initial distributions of information among traders.

As Figure One illustrates, if the mechanisms are portrayed in this fashion, they parallel the criterion for partitioning information sets that implicitly informed Fama's trichotomy of weak/semi-strong/strong form tests of market efficiency. Universally informed trading extends over all widely-disseminated information, including the price-history information that underlies weak form tests. Professionally informed trading operates on all publicly available information, but it is particularly active where information is "semi-public"—i.e., initially distributed or useful to only a minority of sophisticated trading professionals. Professionally informed trading thus links the information sets sampled by semi-strong form tests and by those strong form tests, including studies of mutual fund performance,¹²⁵ that aggregate returns to sophisticated traders over time. By contrast, derivatively informed trading acts most prominently on key trading facts over which very small numbers of traders exercise monopolistic access. It dominates the remaining strong form tests that routinely demonstrate substantial market inefficiency, such as those involving corporate insiders and market specialists. Finally, uninformed trading acts on the "soft" information of forecasts and assessments that is not directly sampled by any of the other tests.¹²⁶

The foregoing analysis does more, however, than merely vindicate a familiar classificatory schema. It also renders explicit the intuition behind the expansion of these categories from a classification of tests to a descriptive language of market responses that implicitly distinguishes among levels of relative market efficiency, a point reflected in Figure One by the correspondence between the relative efficiency continuum, the original weak/semi-strong/strong

¹²⁴ This is not to say that all information will be fully reflected in price, regardless of its initial distribution or trading import. Some inside information may never trigger a sufficiently powerful price signal to alert uninformed traders. Nor is it likely that uninformed trading will ever *fully* reflect optimal forecast data in price, no matter how rapidly it operates. See *supra* note 100.

¹²⁵ See *supra* note 27.

¹²⁶ See *supra* notes 25-27. Of course, to the extent that key facts sampled by semi-strong form tests are successfully forecast prior to their availability as facts, these tests do sample forecast information. See *supra* note 27.

Figure One. Capital Market Efficiency Mechanisms

Traditional Categories of Efficiency	Weak Form	Semi-Strong Form	Strong Form
Relative Efficiency	HIGH		LOW
Initial Distribution of Information Among Traders	BROAD		NARROW
Capital Market Mechanisms	Universally Informed Trading	Professionally Informed Trading	Derivatively Informed Trading
			Uniformed Trading

form trichotomy, and the operative capital market mechanism. This step of focusing *explicitly* on efficiency mechanisms, we submit, completes the project of giving theoretical content to the operational vocabulary of market efficiency theory—the project that began more than a decade ago with analytical efforts to clarify the basic definition of market efficiency.

Much work remains to be done in further illuminating the operation of the four market efficiency mechanisms. Not only is the modeling of each mechanism, considered independently, still in its developmental stage, but attempts to model the synergistic interaction of the mechanisms are even more preliminary.¹²⁷ Research of the latter type may help explain puzzling discrepancies between the actual response of price to new information and the response that any one of the mechanisms considered alone might lead one to expect. Why, for example, does informed trading appear to operate with little loss in relative efficiency down to a quite narrow initial distribution of information among traders, a critical threshold floor of initially informed traders? One answer might be that a threshold number of traders is required to emit a strong price signal. In this case, derivatively informed trading may “amplify” professionally informed trading by alerting the entire analyst community to the existence of new semi-public information.¹²⁸ Similarly, uninformed trading, by reducing price noise levels, may help accelerate price decoding and so contribute to the relative efficiency of derivatively informed trading.

Finally, the cycle is complete when uninformed trading generates prices that reflect high-quality forecasts about future events or facts that are as yet unknown to the market. Such anticipation minimizes the discrepancies between *ex ante* “uninformed” and *ex post* “informed” equilibrium price levels and thereby enhances the relative efficiency of all three informed trading mechanisms. How-

¹²⁷ Recent models joining the aggregation processes of uninformed trading with weak learning from price, see *supra* text accompanying notes 114-19, are a promising first step in this direction, although even these are more extensions of uninformed trading than true dual mechanism models. See *supra* note 116.

¹²⁸ Similarly, weak learning from price may buttress professionally informed trading by rapidly conveying the trading content of the new information to the entire market. See *supra* note 67. In addition, the converse may also be true. Information acquisition by market professionals may increase the overall information content of prices, reduce “noise” in a global sense, and thereby increase the relative efficiency of price decoding. See *supra* note 120.

ever, because uninformed trading works best when large numbers of traders form well-specified assessments about future facts and future events, it will be most efficient when traders are well aware of the importance of such contingencies in advance. That is, uninformed trading works best for "known" uncertainties: those future events that are likely to be widely anticipated before they are known, and widely known when they occur. Such "future facts" are rapidly assimilated into price by the universally informed and professionally informed trading mechanisms.¹²⁹ Conversely, when key trading facts that bear on the forecasting of future events are rapidly disseminated, they help minimize the bias of individual trader assessments and thereby enhance the relative efficiency of uninformed trading.¹³⁰ Thus, the efficiency mechanisms discriminate jointly as well as separately among information sets. Some types of information, such as Federal Reserve Board announcements and routine disclosure reports, are efficiently reflected in price in two ways: *ex ante* in the form of accurate anticipation, and *ex post* in the form of rapid assimilation through the most efficient informed trading mechanisms. Other types of information, of which data about innovation is the best example, may be subject to relatively inefficient assimilation both *ex ante* and *ex post*.

The exact nature and magnitude of such interaction among mechanisms, which presumably contributes to total market efficiency across *all* available information sets, must await future investigation. At this juncture, we must content ourselves with the more limited observation that the four capital market mechanisms function with decreasing relative efficiency. Thus, we expect the breadth of the initial distribution of information among traders to determine the relative efficiency of the market's response.

III. THE INFORMATION MARKET

In the previous section we suggested that the capital market's relative efficiency depends on the initial distribution of informa-

¹²⁹ Uninformed trading works best for "known" uncertainties for two reasons. Many traders will form careful, independent forecasts about these contingencies, thus expanding the information base that is aggregated by price; and, because these contingencies are familiar to the market, trader forecasts will fall within a bounded distribution of expected outcomes, thus increasing the predictive quality of the assessments reflected into price. See *supra* note 109.

¹³⁰ See *supra* note 111.

tion, and that the various capital market mechanisms are not equally effective for all distributions of information. We illustrated these points by arraying both the mechanisms and Fama's original trichotomy of weak, semi-strong and strong form efficiency along a continuum representing the breadth of initial distribution of trading information. Fama's trichotomy, we suggested, was really an approximation of an underlying relationship between how broadly information is initially distributed, and the particular market mechanism—and level of market efficiency—with which it is reflected in price. But while this analysis explains how (and how much) efficiency is achieved given the initial distribution of information among traders, it tells only half the story. Given the operative capital market mechanisms, the relative efficiency of the market's response to particular information depends on the initial distribution of that information among traders. The question now is, what determines that initial distribution?

To answer that question, the focus of our analysis shifts to the operation of a different market: the market for information. Although the distribution of information determines which capital market mechanism will operate and, therefore, how efficient the capital market will be, it is the information market that determines how information is initially distributed. Analysis of the overall process of market efficiency thus requires careful consideration of the structure of the information market.

A. The Central Role of Information Costs

Since efficiency in the capital market depends on the distribution of information, it is ultimately a function of the cost of information to traders. The lower the cost of particular information, the wider will be its distribution, the more effective will be the capital market mechanism operating to reflect it in prices, and the more efficient will be the market with respect to it.¹³¹ Understanding market efficiency, then, requires detailed analysis of the nature and dynamics of information costs.

¹³¹ We recognize that the market reflects expected returns from investments in information as well as the cost of information. The problems associated with assuring a return to investment in information costs was briefly considered in Section II, *supra* text accompanying notes 88-91. We return to this problem again in Section IV after the development of the cost side of the market. See *infra* text accompanying notes 198-205.

1. A Taxonomy of Information Costs

Information costs may be divided into three categories, each corresponding to one of the three forms of active response to uncertainty described in Section I. The first category is costs of *acquisition*. These costs will differ in character depending on whether one is the originator of the information or only its subsequent recipient. For the originator, acquisition costs are the costs of producing the information in the first place (as with a discovery or innovation). For the subsequent recipient, acquisition costs are those of securing access to information produced by someone else. This may be done either with the originator's cooperation, as through purchase, or despite the originator's efforts to prevent access, as, at the extreme, through industrial espionage.

The second category is the cost of *processing* information once it is acquired.¹³² For both the originator and a subsequent recipient, processing costs are best exemplified by investment in human capital. Evaluation of information, whether self-produced or acquired from others, requires special skills, such as a facility in accounting, finance or securities analysis, that can ordinarily be obtained only through investment in expensive professional training. The cost of such training is reflected in the wages of the skilled employee or in the opportunity costs of his or her principal.

The third category of information costs arises from the problem of *verification*. Here the task is to determine the quality of information. How does the acquirer of information determine its accuracy? Like acquisition costs, the expense of verification manifests itself differently depending on whether one is the originator of the information or a subsequent recipient. For the originator, verification costs take the form of further investments to determine the accuracy of the existing information by, for example, hiring an expert to evaluate it.¹³³ A subsequent recipient may undertake similar efforts, but its principal verification cost is that of determining

¹³² When information is acquired by purchase, the acquisition and processing categories of information costs merge to some extent. For example, purchasers must incur processing costs before they can set a price for the information they seek to acquire. The same problem also arises with respect to verification costs. See *infra* text accompanying note 145. Despite the potential blurring of our categories when information is acquired by purchase, they remain analytically useful. Moreover, not all information is acquired by purchase.

¹³³ This example of verification costs is taken from C. Holloway, *Decision Making Under Uncertainty* 351 (1979) (expected value of imperfect information).

the veracity of the originator. The originator will have an incentive to act opportunistically by misrepresenting the accuracy, and therefore the value, of the information.¹³⁴ In this case, verification costs may take the form of a direct investigation by the subsequent recipient, similar in character to the efforts undertaken by an originator, or of alternative verification techniques such as bonding or the use of third party experts.¹³⁵

2. Market Responses to Information Costs

Market participants shape the cost structure of the information market by their efforts to reduce each category of information costs.¹³⁶ Consider, for example, how a general contractor who bids on a construction contract might respond to verification costs. The

¹³⁴ The difficulty of assuring oneself of the value of purchased information has been recognized for some time. See, e.g., Hirschliefer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 *Am. Econ. Rev.* 561 (1971). More generally, the difficulty presented is opportunism, or "self-interest seeking with guile." Williamson, *Transaction-Cost Economics: The Governance of Contractual Relations*, 23 *J.L. & Econ.* 233, 234 n.3 (1979). See generally O. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* 7-10, 26-56 (1975). While opportunism is typically treated as a risk associated with voluntary exchanges, the problem of verification does not disappear when the originator of the information parts with it involuntarily. Suppose the originator suspects the possibility of espionage. The originator's response—"opportunistic" in the sense we use the term—would be to alter the information so as to render it misleading. Allied efforts during World War II to mislead German intelligence as to the site of the invasion of France is one historical example of this phenomenon. More recent examples include the sting operation undertaken by IBM to interfere with industrial espionage directed at it, see Tinnin, *How IBM Stung Hitachi*, *Fortune*, Mar. 7, 1983, at 50, and efforts by Convergent Technologies, Inc., to mislead its competitors by spreading inaccurate rumors about its research work. As Convergent's president described the practice, "[i]f we became uncomfortable that somebody knew too much, we would vector it off [misdirect their attention]." Larson & Dolan, *Thinking Small: Large Computer Firms Sprout Little Divisions For Good*, *Fast Work*, *Wall St. J.*, Aug. 19, 1983, at 1, col. 1. See also *supra* notes 81 & 89 (misinformation through trade and price decoding).

¹³⁵ "Bonding" occurs when the originator of information puts at risk an asset that is forfeited if the information is less accurate than represented. This approach and the range of other actions that can be taken to reduce verification costs is considered *infra text* accompanying notes 136-42. The general problem of verification costs, in relation to products as well as information, is surveyed in Barzel, *Measurement Cost and the Organization of Markets*, 25 *J.L. & Econ.* 27 (1982).

¹³⁶ Market participants always have a cost incentive to minimize market failures of all sorts. Continuing market imperfections then point not to the futility of their efforts, but to the presence of frictions that are irreducible through market efforts. This point is made with respect to externalities generally by Dahlman, *The Problem of Externality*, 22 *J.L. & Econ.* 141 (1979), and with respect to information problems by Barzel, *Some Fallacies in Interpretation of Information Costs*, 20 *J.L. & Econ.* 291 (1977).

size of the contractor's bid depends on, among other things, the accuracy of information provided by a subcontractor about the completion date for its portion of the project. If the general contractor believes that there is a fifty percent chance that this information is incorrect and that the resulting delay will increase overall costs by \$100,000, the general contractor's bid must be \$50,000 higher to reflect the potential inaccuracy.¹³⁷ The general contractor therefore has an incentive to invest in verification, because more accurate information—a lower probability that the information is incorrect—allows it to make a lower and more competitive bid.

But some forms of verification will be more costly than others, in that they will assure less accuracy for a given expenditure.¹³⁸ One approach to the verification problem is "pre-purchase verification" by the recipient of information. In this case, the general contractor would itself investigate the subcontractor by, for example, speaking with others for whom the subcontractor has worked or with the subcontractor's bank. This approach is costly, however, not only because the general contractor must expand resources to acquire the verifying information, but also because the information itself is of limited usefulness. The fact that the subcontractor has completed other projects on time in the past may not be sufficient assurance that it will do so again. An incentive exists not only to verify but to obtain high quality verification as economically as possible.

For this purpose, an alternative form of pre-purchase verification that requires the sub-contractor's cooperation may prove far more successful. The subcontractor may simply warrant that its information is of the represented quality; i.e., that it will complete the project by the promised date. This allows the general contractor to spend less on verification, because its bid may be made as if the subcontractor's information were completely accurate. If the information proves inaccurate, the subcontractor bears the cost.¹³⁹

¹³⁷ For simplicity, the example assumes that the general contractor is risk neutral.

¹³⁸ Techniques used to reduce all three categories of information cost are considered in Section IIIB, *infra* text accompanying notes 143-67.

¹³⁹ Of course, the general contractor must still incur some verification costs to determine whether the subcontractor can satisfy its monetary obligation if it breaches its warranty. The general contractor may resort to credit investigations, letters of credit, and bonding companies to reduce these costs. Note also that the subcontractor will require compensation for providing a warranty that shifts the risk of inaccurate information. However, since the

The general contractor can then learn the true accuracy of the information costlessly as the project proceeds. As a result, its total information costs are reduced, and its bid is more likely to succeed.¹⁴⁰

Economizing on verification costs, moreover, is not limited to a particular technique. Indeed, warranties may prove to be wholly ineffective where the information in question is not the prediction of a single future event—that a project will be completed on time—but is rather a subjective probability distribution of future results.¹⁴¹ Here, subsequent events would not necessarily reveal the accuracy of information; a party who received a warranty would thus have to expend substantial resources to determine whether its warranty had been violated. In such settings, alternative economizing techniques are more effective. For example, the parties may use information intermediaries who offer economies of specialization, scale, and scope in verification that are not available to the individual acquirers of information.¹⁴²

B. Information Costs and Market Efficiency

Our special interest in the information market's economizing process is its relationship to capital market efficiency. If, as we argue, capital market efficiency is a function of information costs, then economizing on information costs pushes the capital market in the direction of greater efficiency. Because the information market determines the breadth of initial distribution of information to the capital market, our approach suggests that the inefficiencies of

subcontractor can more easily verify its own information than can the general contractor, the subcontractor will be the cheaper risk bearer in the absence of significantly different levels of risk aversion.

¹⁴⁰ This technique not only responds to the verification problem, but does so in a way that minimizes the cost of the response. The burden of verification is put on the subcontractor, the party for whom information costs are the lowest. It is simply cheaper for the subcontractor to gather information bearing on the probabilities of his own performance. See Barzel, *supra* note 135, at 28-32.

¹⁴¹ An example is a prediction of the likelihood of a borrower defaulting on an outstanding debt.

¹⁴² See, e.g., Leland & Pyle, *Information Asymmetries, Financial Structure and Financial Intermediaries*, 32 *J. Fin.* 371 (1977); see *infra* notes 147-48. Information intermediaries arbitrage information asymmetries with the same beneficial effect on markets as in any other arbitrage setting. This phenomenon, like that of information asymmetries in general, is pervasive and will receive substantial attention in Sections IIIB and IV, *infra* text accompanying notes 143-205.

the information market—particularly inefficiencies in the distribution of information that arise from transactions costs—should be the focus of analysis.¹⁴³

The overall relationship between information costs, information cost economizing techniques, and the distribution of information, can be effectively depicted in graphic form. Figure Two displays the three categories of information costs, and the market economizing techniques that have developed to reduce each category of costs, along a continuum of absolute cost. Consider first the expense of acquiring information. Where an originator desires to protect its product, the cost of acquisition by a subsequent recipient will be quite high. Information about the product will not be for sale at all or, at best, its sale price will be high. The market will respond to the high cost of the information through economizing techniques such as investigative analysis, careful surveillance of the originator's behavior, or industrial espionage.

These techniques will reduce, to some extent, the acquisition cost to subsequent recipients. In absolute terms, however, cost will remain high for at least two reasons. First, these economizing techniques are themselves quite expensive. Over and above the direct costs, how does one evaluate, for example, the indirect expense to the Japanese computer companies recently indicted for purchasing stolen IBM business secrets?¹⁴⁴ Second, the accuracy of the information acquired is subject to substantial uncertainty. Verification therefore becomes a critical concern; yet the acquirer cannot use most of the conventional market techniques for economizing on verification costs because these require the cooperation of the information's originator. One could hardly expect the originator and involuntary transferor of information to assist in its verification, if only because most of the techniques for acquiring information from such a recalcitrant originator depend on the originator's ignorance of the effort.¹⁴⁵

¹⁴³ This relationship was alluded to, but not pursued, in T. Copeland & J. Weston, *supra* note 19, at 204. See also Gonedes, *supra* note 19 (exploring information production and capital market efficiency in the context of external accounting).

¹⁴⁴ See Tinnin, *supra* note 134, at 50 ("After the arrests, one of Hitachi's foremost objectives in its legal maneuvers was to avoid a trial in which this embarrassing material would be displayed for the world to see and hear.").

¹⁴⁵ If the originator were aware of the surveillance, he could take steps either to falsify the information, see *supra* note 134, or to stop the surveillance.

Figure Two. The Cost Structure of the Information Market

Type of Information Cost		Level of Information Costs				
Verification	Market Response	Pre-existing investment in Reputation	Collective Signalling Civil and Criminal Penalties	Seller Signalling Investment in Firm Specific Capital Bonding Warranties Hostage	Financial Intermediaries Investment Bankers Mutual Funds Insurance/Guarantees Information Intermediaries Rating Agencies	Buyer Verification — Buyer Use of Exports
Processing	Market Response	Financial Press	Economies of Scale and Scope Information Intermediaries Third Party Experts		Individual Human Capital Investment Investment in Support Facilities	
Acquisition	Market Response	Financial Press — Distribution by Originator	Information Intermediaries Collectivization Public Federal Securities Acts Private Analyst Trade Associations	Espionage — Surveillance — Investigative Analysis		
Level of Information Costs		LOW ← → HIGH				

Other examples of market economizing on acquisition costs occur when the originator makes no effort to protect the information, but merely decides not to incur the full costs of distributing it.¹⁴⁶ We then see market efforts to economize on acquisition costs through collectivization at both the private and public levels. At the private level, for example, organizations of securities professionals hold cooperative programs in which high company officials speak to many analysts at once, thus reducing the cost of access for any individual analyst. Indeed, the very existence of information intermediaries such as financial and securities experts reflects, in part, the potential for economies of scale and scope¹⁴⁷ in efforts to economize on information costs.¹⁴⁸

¹⁴⁶ In this case, the information in question is typically not a product that its originator intends to sell, but rather a by-product of its principal activity. A good example of this phenomenon is the gathering of information by analysts through such indirect sources as reports required by trade associations or governmental agencies. Some of this information might not have otherwise been disclosed by the company. Indeed, the company may have been unaware that the information would be considered important by analysts; or it may have feared that disclosure would have an adverse effect on the price of its stock, while nondisclosure would not. But cf. Grossman & Hart, *Disclosure Laws and Takeover Bids*, 35 J. Fin. 323 (1980) (failure to disclose can lead to conclusion that information was unfavorable); see *infra* note 156. On the other hand, the company has an obvious incentive to disclose many types of *favorable* information, thereby reducing the acquisition costs of subsequent recipients. Recipients then face the problem of verifying the information to determine if the originator has behaved opportunistically.

¹⁴⁷ The fact that substantial capital may be needed to acquire and store information generates the potential for economies of scale in this context. Economies of scale in general arise where increased volume allows operation at a lower portion of a declining average cost curve. See generally F. Scherer, *Industrial Market Structure and Economic Performance* 81-104 (2d ed. 1980). A related phenomenon is the experience curve, which describes an inverse relationship between cost and growth in cumulative total output, rather than growth in capacity per period as in economies of scale. Here the idea is akin to that of a learning curve. Production becomes more efficient as the degree of experience increases, because, all other things being equal, we get better at things as we do them more. See generally M. Salter & W. Weinhold, *Diversification Through Acquisition: Strategies for Creating Economic Value* 65-78 (1979).

Economies of scope, on the other hand, shift the inquiry from the impact of volume on the production costs of a single product to the impact of producing a number of related products on the production costs of each. The concept has two general components. The first focuses on economies of hard product costs, such as the ability to use common production facilities for different products. See, e.g., Bailey & Friedlaender, *Market Structure and Multi-Product Industries*, 20 J. Econ. Lit. 1024 (1982). The second seeks to explain why such economies are exploited by a single firm in contrast to other arrangements; it stresses diversification as a means of avoiding high transactions costs. See Teece, *Towards an Economic Theory of the Multiproduct Firm*, 3 J. Econ. Behav. & Org. 39 (1982).

¹⁴⁸ Intermediaries play an even greater role in reducing information processing and verifi-

At the collective level, legislation such as the Securities Exchange Act of 1934,¹⁴⁹ which requires continual disclosure of extensive current information by public companies, eliminates the repetitive cost of individual acquisition of information by each analyst. This form of mandatory disclosure collectivizes information acquisition by requiring the originators of information to distribute it and, in some cases, even requiring them to create it.¹⁵⁰

Market efforts to reduce acquisition costs also occur at the lower end of the cost continuum. For example, a company that wishes to distribute information indicating favorable corporate prospects may do so at little cost merely by issuing a press release. The financial press as an institution functions to reduce the acquisition costs of information recipients, in large part by reducing the costs of voluntary distribution to the originators of information.¹⁵¹

Figure Two also shows how markets economize on the costs of processing information. Perhaps the most pervasive example is the specialized business of securities analysis itself, which permits substantial economies of scale and scope in utilizing human capital. Similar economies are available in the use of the support equipment, such as computer hardware and software, that is increasingly necessary for performance of the analyst's task. As a result, there are specialists in information processing, such as research firms and the research departments of brokerage firms, whose functional advantage is their ability to process information more cheaply than non-specialists.¹⁵²

cation costs. See *infra* text accompanying notes 152 & 159.

¹⁴⁹ 15 U.S.C. § 78a-kk (1982).

¹⁵⁰ Collectivization of production and distribution costs also exploits the economies of scope that exist when the company is already producing similar information and has an established means of distributing it. Cf. Advisory Committee Report, *supra* note 3, at 634-36 (mandated disclosure reduces the incentives to expend resources on non-productive private information search). This is consistent with a "public choice" approach to the regulatory process, which posits that "regulations will tend to favor (subsidize) relatively small and well organized groups that have a high per capita stake in the regulations . . ." S. Phillips & J. Zecher, *The SEC and the Public Interest* 22 (1981). The financial analyst community, which most directly benefits from a reduction in the cost of producing information about publicly traded companies, is precisely the type of group that would be expected to lobby for the adoption of such regulations. *Id.* at 22-23. See *infra* text accompanying note 244.

¹⁵¹ The financial press also plays a role in economizing on processing and verification costs. See *infra* note 152.

¹⁵² The financial press plays a similar role, offering almost continual analysis of corporate and economic prospects. Such collectivization of the processing function reduces costs, but

The category of verification costs, however, yields the most interesting array of market techniques for reducing information costs. Consider the producer of a new financial product. The producer has an obvious incentive to supply the market with information indicating that the product is worth its asking price.¹⁵³ Indeed, the product can be described generally as only an uncertain stream of future income; information concerning the risk and timing of that stream is part of the product itself. But even if distribution by the seller eliminates the cost of acquiring information, a would-be purchaser is still subject to an information cost problem. How does it know whether the information the producer supplies is accurate? After all, the information's producer will often stand to benefit by leading the recipient to overvalue the product. Where the quality of the information is difficult to determine, its buyer has little choice but to assume that it, and the product it concerns, are of lower quality than represented. Only by discounting the information's accuracy can the buyer be certain that he or she has not unknowingly overpaid. The result is that sellers have too little incentive to provide better information, because "it won't be believed anyway." Poor quality information drives higher quality information from the market,¹⁵⁴ and individual buyers who wish to obtain more accurate predictions of a security's value can do so only by making substantial individual investments in verification. Better products will be mispriced because the capital market will not efficiently reflect information about their superior quality.¹⁵⁵

it may discourage independent efforts by traders to process the information more quickly, thoroughly, or creatively. Assuming that the economic advantage to be derived from individual efforts is relatively small, a trader would have to engage in a substantial volume of trading to justify such expenditures. This again suggests a role for intermediaries who, through aggregation, control a volume of trading large enough to make the effort profitable. See J. Lorie & M. Hamilton, *supra* note 7, at 100.

¹⁵³ See, e.g., Grossman & Hart, *supra* note 146.

¹⁵⁴ This is an example of the "lemon problem." E.g., Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 *Q.J. Econ.* 488 (1970); Grossman, *The Informational Role of Warranties and Private Disclosure about Product Quality*, 24 *J.L. & Econ.* 461 (1981); Wilson, *The Nature of Equilibrium in Markets with Adverse Selection*, 11 *Bell J. Econ.* 108 (1980).

¹⁵⁵ One qualification is in order. As both a conceptual and an empirical matter, there is a substantial relationship between market efficiency and the idea that assets are correctly priced. To say that the market has incorrectly priced an asset is to say either that one can correctly predict the proper price of an asset and the market is inefficient because it has priced the asset other than as predicted; or, alternatively, that the market price is efficient

A broad range of market techniques has developed to deal with this problem by reducing verification costs. At the most costly end of the continuum are solutions that rely solely on buyer verification without the assistance of the originator. For example, buyers may employ experts, such as accountants, lawyers, or business consultants, to examine the offered information. Although these techniques still require each buyer to verify the information individually, they do achieve economies of scale with respect to the skills necessary for verification.

Yet these and other buyer verification techniques that function without the seller's cooperation are very costly. Substantial additional savings in verification costs are achieved if the seller itself verifies the accuracy of the information. One such approach relies on the efforts of information sellers, unaided by intermediaries, to "signal" in a believable fashion that they offer high quality information. Signaling in this context means the distribution of a particular type of information. In general, parties signal when they desire to convey information about an attribute that is not otherwise discernible. In our case, that attribute is the seller's propensity to misrepresent the accuracy of the offered information. For the signal to be effective, the seller must show that its interests do not lie in misrepresenting accuracy. The signal therefore contains no new information about the accuracy of the original information in the absence of something that demonstrates that the signal itself is accurate.¹⁵⁶

and it is the prediction—the asset pricing theory—that is incorrect. See Jensen, *supra* note 9, at 96. Indeed, the most common statistical technique for measuring market efficiency is in fact a joint test of both market efficiency and the capital asset pricing model. See, e.g., G. Foster, *supra* note 12, at 363.

¹⁵⁶ The signal must be one that cannot be reproduced by another company whose information is inaccurate. The need for a signal exists precisely because the observable characteristics of the firms do not allow one to differentiate between accurate and inaccurate information. If the signal of a high accuracy firm can be imitated by a low accuracy firm, it will not "facilitate distinguishing between firms whose decisions have different unobservable characteristics." Gonedes, *Corporate Signaling, External Accounting, and Capital Market Equilibrium: Evidence on Dividends, Income, and Extraordinary Items*, 16 *J. Acct. Research* 26, 30 (1978). Scholars have used signaling theory to help explain an increasing range of financial decisions. See, e.g., Bhattacharya, *Imperfect Information, Dividend Policy, and "The Bird in the Hand" Fallacy*, 10 *Bell J. Econ.* 259 (1979) (dividends as a signal of expected cash flows under certain conditions); Gonedes, *supra* note 19 (financial accounting); Grossman & Hart, *supra* note 146 (corporate takeover bids); Ross, *The Determinants of Financial Structure: The Incentive Signalling Approach*, 8 *Bell J. Econ.* 23 (1977) (capital

A typical but costly form of signaling is the investment by sellers in firm-specific capital, such as reputation and advertising, whose value would be reduced if the quality of the product were lower than represented.¹⁵⁷ In situations where this form of investment is not feasible, sellers may employ hostage techniques; for example, a seller may post a bond that is forfeited to the buyer if the information is of lower quality than represented.¹⁵⁸

In other situations, however, the costs of signaling or bonding by the seller will simply be too high; the seller will lack the capital and time to invest in reputation or the funds to post a bond.¹⁵⁹ In many such cases, outside specialists acting as information intermediaries will offer their own reputation in lieu of the sellers' as a bond of quality.¹⁶⁰ Examples of such specialists in the products

structure).

¹⁵⁷ Barzel, *supra* note 135; Grossman, *supra* note 154, at 470-77; Klein & Leffler, *The Role of Market Forces in Assuring Contractual Performance*, 89 J. Pol. Econ. 615 (1981).

¹⁵⁸ See Williamson, *Credible Commitments: Using Hostages to Support Exchange*, 73 Am. Econ. Rev. 519 (1983). A hostage strategy goes beyond simple signaling. It serves not only as a screening technique to allow sellers who are more accurate to identify themselves, but also as a means of reducing the seller's incentive to behave opportunistically when screening alone will not suffice. For the screening technique to be effective, the seller must contemplate future transactions where a penalty will be exacted for having incorrectly signaled. See Klein & Leffler, *supra* note 157; Telser, *A Theory of Self-enforcing Agreements*, 53 J. Bus. 27 (1980). Indeed, a significant portion of Klein and Leffler's analysis is devoted to describing the circumstances in which the *ex post* penalty for cheating will exceed the *ex ante* gain. The hostage technique extends the screening approach to situations where no future transactions are contemplated.

¹⁵⁹ One example involves the role of the investment banker in the mergers and acquisition context. The investment banker acts as an information seller who must verify the accuracy of the information (the acquisition opportunity) it offers for sale to its client. Gilson, *Seeking Competitive Bids Versus Pure Passivity in Tender Offer Defense*, 35 Stan. L. Rev. 51 (1982). One way to reduce the client's verification costs is for the client to "pay" some portion of the investment banker's fee by allocating to the banker some of the client's post-transaction investment banking services. If the information proves to be inaccurate, the client can penalize the investment banker by obtaining these services from another source. This is, however, a very expensive verification technique; it is available only to a diversified information seller, like an investment banker, who can offer post-transaction services to the client. *Id.* at 59.

¹⁶⁰ In some situations a third party is critical to the verification process. Where, for example, the verification problem concerns information provided by the issuer of corporate debt, the issuer's reputation is already at stake and the promise to repay the debt commits the entire financial resources of the issuer. Any additional issuer warranty or bond concerning the accuracy of the information would be superfluous, and some signaling by third parties is necessary. See generally Thakor, *An Exploration of Competitive Signalling Equilibria with "Third Party" Information Production: The Case of Debt Insurance*, 37 J. Fin. 717 (1982) (insurance coverage on corporate debt issue can signal its probability of default). A recent

market are the Underwriter's Laboratory and the Good House-keeping Seal; in the financial markets, the most obvious example is the role played by rating agencies such as Standard & Poor's and Moody's.¹⁶¹ A less obvious but similar role is also played by financial intermediaries, although the verification technique used by these information agents differs.¹⁶² Rather than demonstrating confidence in the accuracy of the seller's information by staking their reputation on it, these financial intermediaries signal their belief by purchasing the seller's offering for their *own* account, thereby staking *their* future directly on the accuracy of the seller's information.¹⁶³

A collective, and therefore potentially less expensive, solution to the problem is the legislative imposition of civil and criminal penalties on low quality producers. By imposing costs only on those producers who would exploit high buyer verification costs by falsely pretending to provide quality information, such legislation makes it more costly for producers of low quality goods to mimic the behavior of high quality producers. At the extreme, well-defined and energetically enforced legislation of this type turns the lemon problem on its head and drives low quality producers from the market. This process may explain in part why trade associations that are dominated by high quality firms often lobby for *more* stringent legislative standards and greater enforcement of those standards.¹⁶⁴

development in municipal financing illustrates this phenomenon. Commercial banks have begun issuing letters of credit to insure municipal bonds against the risk of default. Standard & Poor's has disclosed that, in rating these bonds, it focuses not on the risk of issuer default, but on the risk that the bank will default on the letter of credit. Carrington, Bank Letters of Credit Proliferate, Creating Some New Safety Fears, Wall St. J., Mar. 18, 1983, at 29, col. 3.

¹⁶¹ We will later argue that the role of the investment banker in initial and other risky public offerings is that of a "reputational intermediary." See *infra* text accompanying notes 194-197.

¹⁶² We do not, of course, argue that information intermediation entirely explains the existence of these institutions. Economies of scale and scope are likely to combine with conditions of asymmetrical information and concerns of confidentiality to explain the precise services offered by particular intermediaries. See Campbell & Kracaw, *supra* note 19.

¹⁶³ See Campbell & Kracaw, *supra* note 19; Leland & Pyle, *supra* note 142; Thakor, *supra* note 160. It is precisely this type of behavior that facilitates the trade decoding mechanism. See *supra* text accompanying notes 77-80.

¹⁶⁴ Section 11 of the Securities Act of 1933, 15 U.S.C. § 77k(a) (1982), which imposes liability on underwriters and others for misstatements or omissions in a registration statement, may fit this model. Certainly fairness does not compel imposing liability on under-

Finally, we should briefly consider the low cost end of the verification cost continuum. What residual verification costs attend the sale of information by sellers who have preexisting investments in reputation, such as AT&T, or accompany the sale of information where collective responses to verification costs, such as legislatively imposed penalties for misrepresentation, have already effectively limited entry by low quality producers? Here the residual costs associated with verification should be quite small¹⁶⁵

Figure Two summarizes the cost structure of the information market. Levels of cost associated with particular information differ depending on the extent of acquisition, processing, and verification costs, as well as on the availability of economizing techniques. With this structure in place, we are now in a position to complete the inquiry with which this section began, by examining the relationship between information costs, on the one hand, and the "availability" of information to the capital market, on the other.

Figure Three superimposes Fama's original weak/semi-strong/strong form classification scheme, and the relative efficiency con-

writers in amounts substantially in excess of their profit from engaging in the transaction. Nor is the imposition of liability on underwriters the best means of spreading costs among potential victims. Rather, imposing substantial liability on the underwriter, but with a defense that relieves it of liability if it has made a diligent investigation of the issuer, is better explained by a belief that the behavior of the *issuer*, the ultimate object of the legislation, is constrained more effectively by imposing liability on the issuer's agent than by increasing the penalties imposed on the issuer itself. See Kraakman, *Corporate Liability Strategies and the Costs of Legal Controls*, 93 Yale L.J. 857, 895-96 (1984). The puzzle is to explain, in light of a public choice approach to regulation, see *supra* note 150, why the underwriting community countenanced the imposition of liability.

The historical setting in which the Securities Act of 1933 was adopted probably made some expansion of underwriters' liability inevitable. See Dooley, *The Effects of Civil Liability on Investment Banking and the New Issues Market*, 58 Va. L. Rev. 776, 794-95 (1972). Since 1933, however, the only serious effort to limit underwriters' liability has been the movement that produced the 1934 amendments to section 11, and even they left liability substantially in excess of the underwriter's spread. The traditional explanation for the equanimity with which underwriters have accepted statutory liability is that actual liability has seldom been imposed under section 11. We believe, however, that our analysis suggests an additional explanation. In the absence of liability, it would be difficult for a high quality investment banker to signal its quality to the market in a manner that could not be imitated by a lower quality firm. To the extent that section 11 liability is likely to fall more heavily on low than on high quality investment bankers, it would be in the interest of high quality firms to submit the industry to such liability, thereby imposing additional costs on low quality firms and making it more expensive for them to imitate the signals of high quality firms.

¹⁶⁵ This fact is reflected in recent developments in the investment banking business. See *infra* note 206.

tinuum that underlies it, on Figure Two's depiction of the cost structure of the information market. This juxtaposition reveals that the relative efficiency continuum substantially parallels the information cost continuum. A market is strong form efficient if its prices reflect inside information that is privately held; by definition, the originator of such information wishes to prevent its dissemination. Not surprisingly, all three categories of information costs in this region of Figure Three are at the high end of the cost continuum. Acquisition costs are high because they involve such costly techniques as monitoring the originator's behavior or engaging in commercial espionage. Processing costs are high because the information is less intelligible than it would be if the originator had voluntarily cooperated with the recipient, and because the often surreptitious methods of acquiring such information prevent pooling or other cooperative means of achieving scale economies in processing information. Finally, many of the most effective techniques for economizing on verification costs are unavailable because of the originator's unwillingness to cooperate.

Fama's semi-strong form category also corresponds to a particular range of the information cost continuum in Figure Three. Cooperative efforts frequently reduce the total costs of acquiring information in this region and also achieve economies of scale and scope in processing costs, often through the services of information intermediaries such as financial analysts. Moreover, the availability of verification techniques that rely on the cooperation of originators of information now make economizing on verification costs more effective. These techniques include bonding and hostage strategies, the use of third party verifiers like certified public accountants,¹⁶⁶ and the good offices of intermediaries such as rating

¹⁶⁶ While part of their value lies in their ability to exploit economies of scale and scope, third-party verifiers such as certified public accountants also function as reputational intermediaries. Central to this function is the accountant's reputation for independence; only if the accountant can be expected to treat the client at arm's length is its message of verification believable. This explains the emphasis on independence both in public regulation, see 17 C.F.R. § 210.2-01(b)-(c) (1983) (requirement of independence for recognition as certified public accountant by Securities and Exchange Commission), and in studies of the demand for public accounting services. See, e.g., Benston, *The Market for Public Accounting Services: Demand, Supply and Regulation*, 2 *Acct. J.* 2 (1979); Ng, *Supply and Demand for Auditing Services and the Nature of Regulations in Auditing*, in "The Accounting Establishment" in *Perspective* 99 (S. Davidson ed. 1979); R. Watts & J. Zimmerman, *The Market for Independence and Independent Auditors* (June 1981) (University of Rochester Center for

services and financial intermediaries.

Fama's final category, weak form efficiency, parallels cost conditions at the low end of the cost continuum in Figure Three. In this region, acquisition costs are minimal and the marginal costs of producing and distributing information are low. Such conditions are perfectly consistent with the form of information typically associated with weak form efficiency, namely, historical price information. This information is an ordinary byproduct of market trading: the organized securities exchanges produce it as a routine service,¹⁶⁷ and the financial press serves to collectivize its low cost dissemination.

An important insight emerges from the discussion of the correlation between the relative efficiency continuum described by Fama's categories and the cost characteristics of the market for information: relative efficiency is a function of information costs. Holding constant the capital market mechanisms discussed in Section II, the market becomes more efficient as the cost of information decreases. Put in terms of the Fama definition, the information *available* to be reflected in price by the capital market is determined by cost conditions in the information market.

IV. THE CAPITAL MARKET AND THE INFORMATION MARKET: THEORETICAL APPLICATIONS OF THE SYNTHESIS

In Sections II and III we considered separately the two elements of the common definition of market efficiency in order to understand the mechanisms that determine the level of capital market efficiency. Looking first in Section II at the capital market mechanisms that reflect information in price, we argued that which

Research in Government & Business, Working Paper No. GPB 80-10). An issuer can internalize some of the economies of scale and scope of outside auditors by conducting a substantial portion of its audits internally, but it can never internalize their reputational role.

¹⁶⁷ An attempt further to reduce the costs of acquiring price information is reflected in the efforts of the Securities and Exchange Commission to create a National Market System pursuant to the Securities Acts Amendments of 1975, Pub. L. No. 94-29, § 1, 89 Stat. 97 (1975). These efforts include, with varying degrees of commitment and success, the creation of consolidated tape and quotation reporting systems; the linkage of major exchanges, by providing participants in any exchange access to offers on all others; and a linkage of NASDAQ, the over-the-counter quotation system, with the Intermarket Trading System, which links the New York Stock Exchange with major regional exchanges. See generally R. Jennings & H. Marsh, *supra* note 2, at 492-97; Poser, *Restructuring the Stock Markets: A Critical Look at the SEC's National Market System*, 56 N.Y.U. L. Rev. 883 (1981).

mechanism is operative, and the concomitant efficiency of the market with respect to particular information, is a function of the initial distribution of that information among traders. A wider distribution triggers a more effective capital market mechanism and thus makes for greater relative efficiency in the capital market. We then shifted our focus in Section III to what determines the initial distribution of information among traders. This required examination of the cost structure of the information market, which led us to conclude that, holding capital market mechanisms constant, the distribution of a particular piece of information is a function of its cost. If information is less costly, it is more widely distributed and more efficiently reflected in securities prices. This approach integrates the functioning of the information and capital markets. From the perspective of the capital market, market efficiency is a function of the initial distribution of information among traders; from the perspective of the information market, market efficiency is a function of the costs associated with particular information. The common factor is information costs.

Our integration of the capital and information markets is depicted in Figure Four, which combines the relationship between capital market mechanisms and relative efficiency shown in Figure Two with the relationship between cost conditions in the information market and relative efficiency shown in Figure Three. As in Figures Two and Three, the level of market efficiency appears on the capital market side as a function of the initial distribution of information among traders, and on the information market side as a function of the information costs attending that information. The juxtaposition of these two relationships demonstrates the link between the capital and information markets. The information cost continuum, lying immediately above the measure of relative efficiency, parallels the distribution of information continuum, lying immediately below a similar index of efficiency. As information costs decline, more—and better—information is available to more traders, and the market becomes more efficient, both because the information is better and because its wider distribution triggers a more effective capital market mechanism. The intuition underlying this relationship is also reflected in Figure Four. Consider the most efficient range of the relative efficiency continuum, that associated

Figure Four. Integrating the Capital and Information Markets

Type of Information Cost		Verification	Market Response	Pre-existing Investment in Reputation	Collective Signalling Civil and Criminal Penalties	Seller Signalling Investment in Firm Specific Capital	Bonding Warranties Hostage	Financial Intermediaries Investment Bankers Mutual Funds Insurance/Guarantees Information Intermediaries Rating Agencies	Buyer Verification — Buyer Use of Experts
Acquisition	Processing	Market Response	Financial Presses	Economies of Scale and Scope Information Intermediaries Third Party Experts	Individual Human Capital Investment in Support Facilities				
	Acquisition	Market Response	Financial Presses — Distribution by Originator	Information Intermediaries	Collectivization Public Federal Securities Acts	Private Analyst Trade Associations	Espionage — Surveillance — Investigative Analysis		
Level of Information Costs		LOW		HIGH		LOW		HIGH	
Relative Efficiency		HIGH		LOW		HIGH		LOW	
Traditional Categories of Efficiency		Weak Form		Semi-Strong Form		Strong Form			
Relative Efficiency		HIGH		LOW		HIGH		LOW	
Initial Distribution of Information Among Traders		BROAD		NARROW					
Capital Market Mechanisms		Universally Informed Trading		Professionally Informed Trading		Derivatively Informed Trading		Uninformed Trading	

with the weak form portion of the Fama trichotomy.¹⁶⁸ The acquisition cost of information in this range can be as low as the price of a newspaper. Such information is also easy to process and nearly costless to verify.¹⁶⁹ As a result, it is widely distributed.¹⁷⁰ Indeed, it almost meets the sufficient condition for market efficiency reflected in the perfect market assumption: that the information be costlessly available to all traders.¹⁷¹

The core of our analysis, then, is that the cost of information critically determines market efficiency because it dictates not only the amount of information attending a particular security but also the distribution of that information among traders, which in turn

¹⁶⁸ An overwhelming body of empirical evidence attests to the existence of weak form efficiency. See *supra* note 25.

¹⁶⁹ A possibility of price manipulation always exists, but the costs of policing against this danger suggest a collective rather than an individual response, consistent with the anti-manipulation provisions of the Securities Exchange Act. From this perspective, the prohibitions in section 9 of the Exchange Act against, for example, creating "actual or apparent active trading in [any] . . . security or raising or depressing the price of such security, for the purpose of inducing the purchase or sale of such security by others," 15 U.S.C. § 78i(a)(2) (1982), are a collective effort to preserve the integrity of the trading information upon which the capital market mechanisms, particularly derivatively informed trading, depend. So understood, the Securities Exchange Act makes it illegal to create "noise" intentionally or to employ price and volume to disseminate misleading signals that reduce the informativeness of price. See *supra* note 120 (concept of noise); *supra* note 89 (market manipulation).

¹⁷⁰ In an important sense, Figure Four, as well as the preceding figures, is far too simple. (This conclusion is precisely the opposite of that reached by some readers of an earlier draft of this article.) The problem is that the vertical relationships reflected in the figures and in the preceding text do not adequately express the fact that these relationships are not fixed, but will differ depending on the type of information in question and its institutional setting. For example, it is easy to imagine types of information, such as newspaper reports of arcane scientific discoveries, whose acquisition costs are low but whose processing costs will be quite high. This suggests that the three horizontal arrays of information costs really ought to be constructed as if they were part of a slide rule and could be repositioned in relationship to each other as the particular situation required. To do so, however, would turn the figures into an impediment rather than an aid to understanding. This is, to be sure, precisely the criticism leveled against the figures originally, but at this point even their creators would agree.

An additional complication should also be noted. The very act of processing or verifying information can transform it into different information, see *supra* text accompanying notes 43-44. As a result, facially identical information may have different distributions and be the subject of different capital market mechanisms. Thus, for example, the surface content of a bit of widely distributed information—perhaps new demographic figures—will be incorporated into price via the universally informed trading mechanism, while the deeper insights of those who invested in processing or verification will be incorporated into price via the professionally informed trading or derivatively informed trading mechanisms.

¹⁷¹ See *supra* text accompanying notes 57-60.

determines the operative capital market mechanism. This focus on information costs also identifies the invisible hand that moves the market toward greater informational efficiency. Information market incentives lead to economizing on information costs and thus to the availability of more effective capital market mechanisms. The result is an integrated understanding of the mechanisms of market efficiency that we believe provides both theoretical insights and new opportunities for employing the market efficiency concept to inform regulatory policy.

In this section we apply our synthesis of the operation of the capital and information markets to two theoretical puzzles. The first is to explain the investment banker's role in increasing the efficiency of the market's response to innovative financial products. The second is to understand the apparent conflict between empirical evidence that the capital market is weak form efficient and the theoretical insight, discussed in Section IIC,¹⁷² that prices can never be fully efficient with respect to any genre of information.

A. The Role of the Investment Banker

Consider the problem of a company that has developed an innovative senior security that better responds to a problem endemic to all senior securities, namely the risk of opportunistic behavior by junior securities holders. Once the terms of a senior security are fixed and it is sold, the holders of senior and junior securities face an inherent conflict of interests. Because the holders of senior securities paid a price based on the existing risk of the business, a post-issuance increase in risk transfers wealth from them to the holders of junior securities.¹⁷³ Purchasers of senior securities recog-

¹⁷² See *supra* text accompanying note 90.

¹⁷³ This may be seen by recharacterizing the interest held by the junior security holders as an option. The junior security holders have "sold" the company to the senior security holders in return for the amount paid for the senior securities, a management contract, and a call option entitling the junior security holders to repurchase the company by satisfying the terms of the senior securities: repaying the face value of the indebtedness where the senior securities are in the form of debt, or continuing the dividends where the senior securities are in the form of preferred stock. If the company is worth more than the exercise price of the option, the junior security holders will exercise their option. If the company is worth less, the junior security holders presumably will not exercise it, by defaulting on the debt or passing preferred dividends. They will thereby allow the senior security holders to "keep" the company through a formal bankruptcy reorganization or through the usual right of pre-

nize this risk, however, and reduce the price they will pay in anticipation of opportunistic behavior by junior security holders. In the end, the cost of such opportunism is borne by the company through receipt of a lower price for its senior securities. It is therefore in the company's interest to reduce the potential for opportunistic behavior by junior security holders. This effort commonly takes the form of contractual limitations expressed either in the bond indenture when the senior security is debt¹⁷⁴ or in the preferred stock contract when the senior security is equity.¹⁷⁵ Because no contractual prohibition is perfect, however, the potential for some opportunism remains. In theory, an issuer who can further reduce this potential by devising a more effective contractual prohibition will secure a higher price for an otherwise identical security.

Now suppose an issuer develops an innovative contract term that dramatically reduces the potential for opportunism by junior security holders.¹⁷⁶ How do market prices come to reflect the value

ferred holders to name the board of directors when preferred dividends are in arrears. See generally Black & Scholes, *The Pricing of Options and Corporate Liabilities*, 81 J. Pol. Econ. 637 (1973) (analyzing corporate liabilities as combinations of options); Gilson, *The Case against Shark Repellent Amendments: Structural Limitations on the Enabling Concept*, 34 Stan. L. Rev. 775, 834 n.229 (1982) (analyzing conflicts between preferred and common stockholders). Examination of the determinants of the value of the junior security holders' option shows that an increase in the riskiness of the company's business results in an increase in the value of the option (and a corresponding decrease in the value of the senior security). See, e.g., R. Brealey & S. Myers, *Principles of Corporate Finance* 433-41 (1981); J. Van Horne, *supra* note 41, at 80-88. While an increase in risk—the variability of the potential value of the business—increases both the potential gain and loss of the option holder relative to the exercise price, the gain is unlimited while the loss is bounded by the price paid for the option. If the company is worth less than the exercise price, the junior security holders simply will not exercise the option. The junior security holders therefore have a substantial incentive to behave opportunistically by altering the company's investment behavior to increase the risk of its business.

¹⁷⁴ See Kalay, *Stockholder-Bondholder Conflict and Dividend Constraints*, 10 J. Fin. Econ. 211 (1982); Smith & Warner, *On Financial Contracting: An Analysis of Bond Covenants*, 7 J. Fin. Econ. 117 (1979). Cf. Ho & Singer, *Bond Indenture Provisions and the Risk of Corporate Debt*, 10 J. Fin. Econ. 375 (1982) (examining the effect of alternative bond indenture provisions on allocation of risk between claimants); John & Kalay, *Costly Contracting and Optimal Payout Constraints*, 37 J. Fin. 457 (1982) (effort to derive the most effective form of constraint for a debt contract).

¹⁷⁵ Gilson, *supra* note 173, at 834 n.229.

¹⁷⁶ *Franklin Life Ins. Co. v. Commonwealth Edison Co.*, 451 F. Supp. 602 (S.D. Ill. 1978), *aff'd per curiam*, 598 F.2d 1109 (7th Cir.), cert. denied, 444 U.S. 900 (1979), and *Morgan Stanley & Co. v. Archer Daniels Midland Co.*, 570 F. Supp. 1529 (S.D.N.Y. 1983), demonstrate the continuing potential for such innovation. Both cases hold that high interest rate

of this innovation? To understand the process by which the innovative security is priced "correctly" by the market, one must first address the problem of information costs. The difficulty is not, of course, with the acquisition of information by prospective buyers; the issuer's interest is to distribute information about the innovation as widely as possible in order to sell the new security. Rather, the problem lies with the costs to prospective buyers of processing and verifying information about the innovation. In order to process the information, buyers must understand how the new security ostensibly reduces the risk of opportunism as well as know how much the asserted protection is worth. In order to verify the information, buyers must evaluate its accuracy in light of the danger that the issuer is opportunistically misrepresenting the value of the innovation.

It is entirely possible, however, that potential buyers will not find the new security at all attractive if they have to bear the full expense of these processing and verification costs. Ironically, one reason that the new security may not be attractive is itself the result of past market efforts to economize on information costs. Conventional securities that compete with the novel security will have virtually identical contractual provisions prohibiting opportunism.¹⁷⁷ This repeated use of the same form document will eliminate the costs of determining, for each new issue, what alternative formulations mean and how effective they are.¹⁷⁸ But this technique's very success in reducing information costs for issuers using the "market" form document will also serve to create a barrier for innovators: buyers' alternative investment opportunities impose far lower information costs than the innovative product requires. In

securities—preferred stock in *Franklin Life* and bonds in *Morgan Stanley*—could be refinanced by the issuer more promptly following a drop in interest rates than language in the preferred stock contract and bond indenture suggested. Moreover, the effect on the market price of the preferred stock following announcement of the redemption in *Franklin Life* strongly suggests that the market had not anticipated that such refinancing was allowable.

¹⁷⁷ Kalay, *supra* note 174, examined the bond indentures on a randomly selected sample of 150 companies listed in Moody's Industrial Manual. Of the 135 reporting a form of bond covenant that limited the amount of dividends that could be paid, 128 used the form recommended by the American Bar Foundation in its Commentaries on Indentures (1971).

¹⁷⁸ This suggests an alternative explanation for contractual boilerplate. One does not change, or even discuss, its content from transaction to transaction not because it is unimportant, but because boilerplate serves to reduce information costs. This function should be familiar to practicing lawyers who will often save negotiating costs by accepting contractual formulations from prior transactions with which they are already familiar.

this situation, how can the market become efficient with respect to the innovation? Correct pricing will not occur automatically. If each potential purchaser must educate itself about the innovation and verify for itself the accuracy and good faith of the issuer, the information will not be widely distributed. Indeed, some of it may not be distributed at all because the costs to each potential purchaser may simply be too great. High information costs, then, lead to a narrow distribution of fully understood and verified information, a comparatively ineffective set of capital market mechanisms, and market prices that remain in the inefficient range of the relative efficiency continuum. If information costs are high enough, the issuer might not realize any return on its investment in developing a better security, and market inefficiency would operate as a complete barrier to innovation.¹⁷⁹

It is in the issuer's own interest, then, to help reduce information costs. Our approach to market efficiency leads to considering the role of the investment banker as an agent for economizing on information costs.¹⁸⁰

Investment bankers are typically seen as having two principal functions in the distribution of securities. First, investment bankers serve as distributors for the issuer, providing the sales force and facilities necessary to sell the securities to the public.¹⁸¹ Second, they provide a form of risk sharing or insurance, at least in connection with "firm commitment underwriting,"¹⁸² that relieves the issuer of some of the risks inherent in the offering of a security.¹⁸³ But even taken together, these two functions do not entirely

¹⁷⁹ In the absence of an expectation of a return on investment in innovation, the issuer would have no incentive to make the investment.

¹⁸⁰ While we discuss the investment banker's function primarily in the context of innovative securities, the investment banker has a role to play whenever verification is costly.

¹⁸¹ See, e.g., SEC Securities Act Release No. 15,807, 44 Fed. Reg. 28,574 (1979), reprinted in [1979 Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 82,073 (May 9, 1979). See also Baron, *The Incentive Problem and the Design of Investment Banking Contracts*, 3 J. Banking & Fin. 157 (1979) (examining the incentives bearing on the underwriter's performance of the distribution function).

¹⁸² There are two principal forms of underwritten offerings: *best efforts* underwriting, where the underwriter agrees only to use its best efforts to sell the securities, and the issuer bears the risk that some or all of the securities will not be sold; and *firm commitment* underwriting, where the underwriter agrees to purchase the securities from the issuer, and the subsequent public distribution is, at least technically, for the underwriter's own account.

¹⁸³ Such risks include the danger that a change in market conditions will affect the price of the offered security or, alternatively, the number of units that can be sold at the anti-

explain the modern underwriter's role. While distribution is obviously an important function, a sizable percentage of the total underwriting compensation goes to participants who do not actually engage in selling the security.¹⁸⁴ Nor does risk sharing account for the remainder of the modern underwriting function, since the underwriter need bear little risk even in a firm commitment underwriting.¹⁸⁵ In a typical firm commitment underwriting, the price that the underwriter pays to the issuer is not set, and the underwriter is not committed to purchase the securities, until approximately twenty-four hours before the registration statement is declared effective and the public sale of the securities commences.¹⁸⁶ The issuer thus bears virtually all risk of changed market conditions prior to the commencement of sale.¹⁸⁷ Moreover, the practice

pated price. See, e.g., 1 L. Loss, *Securities Regulation* 159-72 (2d ed. 1961); Mandelker & Raviv, *Investment Banking: An Economic Analysis of Optimal Underwriting Contracts*, 32 J. Fin. 683, 683-84 (1977) ("Underwriting is the insurance function of bearing the risks of adverse price fluctuations during the period in which a new issue of securities is being distributed.").

¹⁸⁴ A typical allocation of the underwriting fee in an offering would be 20% to the managing underwriter for having the client, 30% to the members of the underwriting syndicate for the expenses of the offering, and 50% to those who actually sell the securities at retail. R. Jennings & H. Marsh, *supra* note 2, at 21. The importance of the distribution function seems to be growing. See SEC Securities Act Release No. 15,807, *supra* note 181, at 28,574, reprinted in [1979 Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 82,073, at 81,758 ("The selling concession in recent years has grown as a percentage of the gross spread, apparently reflecting the increased importance of selling efforts to a successful underwriting."); Robertson, *The Underwriters Have to Offer Even More*, *Fortune*, January 1973, at 116.

¹⁸⁵ See Smith, *Alternative Methods for Raising Capital: Rights Versus Underwritten Offerings*, 5 J. Fin. Econ. 273, 288-89 (1977).

¹⁸⁶ See, e.g., Schneider, Manko & Kant, *Going Public: Practice, Procedure and Consequences*, 27 Vill. L. Rev. 1, 24 (1981). The time when the offering can commence can be predicted with precision. The SEC first must advise the issuer that the registration statement is acceptable, and then the statement is typically declared effective immediately following filing of the pricing amendment, which discloses the price set by the purchase agreement. The purchase agreement itself protects against any unforeseen delay by conditioning the underwriters' obligations to purchase the securities on the prompt effectiveness of the registration statement. See, e.g., 6 R. Shapiro, A. Sachs & C. Olander, *Securities Regulation Forms*, Form 1-3, at 1-38 (1975) (example of purchase agreement).

¹⁸⁷ A recent example illustrates the point. Imagic, a privately held manufacturer of video game cartridges, had filed a registration statement for an initial public offering. It was very close to signing a purchase agreement when disclosure by a competitor, Atari, of lower than expected sales and earnings caused a sharp drop in the stock prices of video game manufacturers and, presumably, the price at which the Imagic issue could be sold. The underwriters did not share in the risk of this event; rather, the offering was cancelled and the issuer bore the entire risk. See Imagic Inc. to Delay Offer Due to Market's "Unsettled Condition," *Wall St. J.*, Dec. 13, 1982, at 20, col. 2.

of soliciting "indications of interest"—non-binding statements of intent to buy the securities—from prospective purchasers during the period between the filing of the registration statement and the commencement of sales further reduces the risk that the securities will be priced too high.¹⁸⁸

The only risk that then remains for the underwriter to "share" is that of a change in market conditions during the short period, typically no more than a week,¹⁸⁹ required by the underwriter to complete the sale. But even here the underwriter need bear little risk; the futures and options markets permit it to hedge the risk of market changes during the offering period. For example, if the underwriter fears that interest rates may rise while it is trying to sell a fixed rate bond, it can eliminate all risk by selling treasury bills for future delivery.¹⁹⁰ Similar hedging of overall market conditions is possible in equity offerings through the use of futures markets in various stock composites.¹⁹¹

If distribution and risk sharing do not adequately account for the investment banker's function, some additional factor must be at work. Our analysis suggests that investment bankers play a third role, that of an information and reputational intermediary, which is particularly important in the context of new issues and other innovations.

¹⁸⁸ See Securities Act Rule 134(d), 17 C.F.R. § 230.134(d) (1983) (allowing solicitation of written indications of interest with delivery of preliminary prospectus bearing required legend).

¹⁸⁹ See Schneider, Manko & Kant, *supra* note 186, at 25 ("final settlement with the underwriters usually takes place seven to ten days after the registration statement has become effective").

¹⁹⁰ An increase in interest rates will result in a loss on the underwriting, because the increase will reduce the value of the bonds. But the increase will result in a profit on the treasury bill sale, because it will decrease the price of the treasury bills that must be purchased to make future delivery. The mechanics of this form of hedging are described in Draper, *Financial Futures for Hedging Long-Term Debt*, *Harv. Bus. Rev.*, Mar.-Apr. 1983, at 172. See Guzzardi, *The Bomb I.B.M. Dropped on Wall Street*, *Fortune*, Nov. 19, 1979, at 52 (use of hedging by first Boston and Salomon Brothers to reduce exposure in \$1 billion IBM debt offering).

¹⁹¹ For example, option contracts are available on the value of the Standard & Poors 500 list through the Chicago Mercantile Exchange, on the New York Stock Exchange Composite Index through the New York Futures Exchange, and on the Value Line Composite Index through the Kansas City Board of Trade. This strategy would not protect an underwriter against unfavorable events affecting only the issuer of the security (unsystematic risk). However, the detailed representations and warranties concerning its business made by the issuer in the purchase agreement provide a hedge against such surprises during the period in which the securities are sold. See, e.g., 6 R. Shapiro, A. Sachs & C. Olander, *supra* note 186, at 1-31 to 1-35.

Recall the problem facing an innovative issuer. Buyers find it too expensive to determine for themselves whether the issuer's new form of security warrants a higher price; and even if the issuer could educate them individually, the verification problem remains. Buyers still must be convinced of the accuracy of the information the issuer provides. A reputable investment banker may be able to solve both problems. Processing costs are obviously lower for a single investment banker than for a disparate group of individual buyers. This fact reflects the savings that accrue both from collectivization and from the potential for scale and scope economies in information processing.¹⁹²

From our perspective, however, the investment banker's role in reducing verification costs is even more critical. The difficulty confronting the issuer and prospective buyers is that determining the quality of the issuer's information is expensive *ex ante*, but not *ex post*. Before the sale, prospective buyers must incur verification costs to assess the issuer's good faith; after the sale, the issuer's behavior will reveal the quality of the information at virtually no cost. In this setting, a common technique for economizing on information costs is for sellers to make capital investments in brand name or reputation as a means of signaling the quality of the information. By making the investment in reputation, the seller signals its belief that when the purchaser learns the truth *ex post*, the quality of the information provided by the seller *ex ante* will be proved high. If the original information proves to be of low quality, the value of the seller's investment in reputation will diminish. Thus, the seller's investment in reputation demonstrates that it is not in his interest to misrepresent the accuracy of its information; and the buyer can rely upon that signal in lieu of engaging in costly verification itself.¹⁹³

The disadvantage of this economizing technique, however, is that in many cases it may not be available to an information seller. First, the seller may lack the capital to invest in a reputation.¹⁹⁴

¹⁹² See *supra* text accompanying note 147.

¹⁹³ See *supra* text accompanying note 157.

¹⁹⁴ Even if the seller has the capital to invest in reputation, it still may be cheaper to "rent" a reputation depending on the size and frequency of anticipated offerings. There are economies of scale in the creation and use of reputations.

Second, it may lack the time to build a reputation prior to the contemplated sale. Third, even if the seller is willing to invest the necessary time and resources, prospective buyers may still harbor doubts about the its good faith—an investment in reputation cannot wholly eliminate the incentive to behave opportunistically. Suppose, for example, that an issuer contemplates going to the capital market only once, and thereafter intends to finance its growth internally. In that case, an investment in reputation may be not a bond but bait, willingly lost in order to catch a more valuable fish. The gains from opportunism may well exceed the costs of lost reputation. Finally, each of these three difficulties—of money, time, and lingering suspicion—are particularly acute when an issuer makes its first offering.

It is in this setting that the critical role of the investment banker as a reputational intermediary becomes clear. In essence, the investment banker rents the issuer its reputation. The investment banker represents to the market (to whom *it*, and not the issuer, sells the security) that it has evaluated the issuer's product and good faith and that it is prepared to stake its reputation on the value of the innovation. Moreover, because the investment banker, unlike the issuer, is certain to be a "repeat player" in the capital markets, there are no final period problems to dampen the signal of value.¹⁹⁵

The investment banker's role as an informational and reputational intermediary can dramatically affect the efficiency of the market's response to an innovative security. As the cost of information about the security is reduced, information is more widely distributed and, therefore, more effectively reflected in market price.¹⁹⁶ Of course, the market never becomes *completely* efficient

¹⁹⁵ Baron, A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues, 37 J. Fin. 955 (1982), and Baron & Holmstrom, The Investment Banking Contract for New Issues Under Asymmetric Information: Delegation and the Incentive Problem, 35 J. Fin. 1115 (1980), focus on a different, but related, informational role for investment bankers. They argue that the investment banker has much better information concerning what the issuer's securities are worth than the issuer, and the resulting asymmetry is between the banker and the issuer rather than between the issuer and the buyer. Our focus here is on the latter asymmetry, which Baron notes but does not pursue. Baron, *supra*, at 956.

¹⁹⁶ The role of investment bankers in reducing information costs is also apparent from an examination of their historical development. For example, Goldman Sachs & Co. had its origin in Marcus Goldman's commercial paper business, in which he would purchase short-

with respect to the innovative security. Information costs are always greater than zero: information concerning the innovation will not be perfectly processed, and the investment banker's signal, itself costly, will not be perfectly credible. The market price of the innovative security will therefore still be lower than it would be if information costs were zero. Nonetheless, the investment banker helps make the market *more* efficient than it otherwise would be. And from our perspective, a more complete picture of the role of this critical actor in the capital markets demonstrates the value of understanding the relationship between information costs and market efficiency.¹⁹⁷

term notes from small manufacturers for resale to banks. V. Carosso, *Investment Banking in America* 19 (1970). The early development of investment banking, during periods when more primitive communication capability—in terms of both technology and a common accounting language—served to ensure very high barriers to verification, may best be understood from the perspective of information costs. Cf. F. Allen, *The Great Pierpont Morgan* 70-71 (1965) (Morgan firm's unprecedented reorganization and underwriting fees justified in large part by the enormous value of the Morgan reputation; Morgan firm's efforts to tie up further control of reorganized railroads in voting trust was necessary to safeguard its reputation).

¹⁹⁷ An understanding of the investment banker's cost-economizing role as a reputational intermediary may also help unravel what Brealey & Myers have described as one of "the ten unsolved problems in finance." R. Brealey & S. Myers, *supra* note 173, at 735, 738. Ibbotson, *Price Performance of Common Stock New Issues*, 2 *J. Fin. Econ.* 235 (1975), found that initial public offerings are significantly underpriced. An investor purchasing a portfolio of such securities in their initial offering would earn an abnormal return of 11.4% over the first month. The puzzle is to explain this phenomenon. Of course, the strength of the underwriter's bargaining position may reduce the prices that issuers receive for their securities. Cf. Baron, *supra* note 195, at 972-74 (unseasoned issuers that are less informed about market demand for their securities are more likely to accept too low a price from investment bankers). But the question remains as to why the investment bankers would pass the benefit on to the public.

Our approach to the puzzle begins by recognizing that underwriters, as reputational intermediaries, reduce verification costs, and so increase the value of offered securities. And while Smith, *supra* note 185, has argued that competition in the market for verification from legal, accounting and engineering firms would limit "the benefit of whatever 'expert' valuation by the investment banker associated with an underwriting . . . to the difference in costs between certification through the underwriting process and independent certification," *id.* at 285, the fact is that there are no comparable reputational intermediaries. The certification function of lawyers, accountants and engineers, while real, see *supra* note 167, is substantially more limited.

In part, how the issuer and the underwriter split the increase in value arising from verification depends on competitive conditions in the market for underwriters, information asymmetries, and the costs of contracting. Baron, *supra* note 195. The underwriter's portion of the increase represents a deduction from the price the issuer would receive if information were costless and verification unnecessary. The problem, however, is that abnormal returns to investors also represent such a deduction. Why do investment bankers content them-

B. The Efficiency Paradox

A second theoretical application of our thesis resolves, at least in part, the "Efficiency Paradox" developed by Sanford Grossman.¹⁹⁸ In Section IIC we considered the conflict identified by Grossman between the need for a return on investment in information and the existence of an efficient information market. If market efficiency with respect to particular information means that one cannot earn a normal return on its acquisition, then information ac-

selves with half a loaf, when they are apparently in a position to claim the public's share as well?

The answer, we think, lies in the fact that the investment banker provides verification by pledging its investment in reputation as a bond that the information offered by the issuer is correct. But characterizing the banker's reputation as an investment raises the issue of what form that investment takes. We argue that passing on to the customer a portion of the return the underwriter receives for pledging its reputation is best understood as a capital investment in reputation, a way of ensuring that the customer's ex post experience will be consistent with the issuer's and investment banker's ex ante representations. And, like corporate image advertising, an investment in reputation is a wasting asset that requires ongoing replenishment. A reputation for accurate pricing in the past does not eliminate the need for continued investment in the future. This analysis is consistent with competitive conditions in both the market for supplying investment banking services to issuers and the market for selling new securities to the public. It merely suggests an additional capital cost associated with successfully operating in such markets.

That underwriters may underprice an issue in order to dispose customers favorably toward future issues is not original to us. Indeed, Ibbotson considered and rejected just such an explanation for his empirical results: "Although this explanation is prevalent on Wall Street, it clearly violates an efficient market framework." Ibbotson, *supra*, at 264. Our information cost analysis of market efficiency, however, alters the framework to which Ibbotson refers. Positive verification costs, in the form of payments from issuers to underwriters for acting as reputational intermediaries and payments by underwriters to customers as investments in reputation, are entirely consistent with an efficient market framework in anything other than the frictionless world of perfect markets. Our explanation might be tested in part by investigating whether the extent of underpricing depends on the magnitude of the investment banker's reputation.

Saul Levmore questions our explanation by pointing out that while the *average* abnormal return for new issues was positive in Ibbotson's study, there was considerable variance within the portfolio, with a substantial number of issues earning *negative* abnormal returns. How good an investment in reputation can this form of underpricing be if nearly as many customers lose as win? See Levmore, *Efficient Markets and Puzzling Intermediaries*, 70 Va. L. Rev. 645, 657-59 (1984). Given the difficulty of ex ante valuation, it is hardly surprising to find such high variance. But the underwriter would have to ensure that its customers acquired most or all of the portfolio; otherwise, the reputational effect might not be favorable. This is, in fact, consistent with the common practice of allocating "hot issues" to one's best customers, thereby both insuring that the investors' overall return will approximate the mean regardless of the variance, and nicely limiting the investment in reputation to the most important audience.

¹⁹⁸ See *supra* text accompanying note 90.

quisition will cease when the market becomes efficient. No one will invest in costly information if he cannot earn a return on it, and the market will become inefficient again. The result will be constant disequilibrium—a vacillation between efficiency and inefficiency powered by the need for a positive return on investment as an incentive to acquire costly information. Grossman resolved this conflict, it will be recalled, by introducing the concept of noise: so long as prices do not disclose all information, there will be an “equilibrium degree of disequilibrium”¹⁹⁹ somewhere short of full efficiency.

This resolution coincides with our information cost analysis of the mechanisms of market efficiency; the market we describe is simply not perfectly efficient. While we do argue that an evolutionary bias pushes the market *toward* efficiency, the Efficiency Paradox arises only when *full* efficiency is achieved. Our very emphasis on information costs recognizes that prices need not be perfectly efficient with respect to any particular information. Nevertheless, the central question posed by the Efficiency Paradox remains: Is the market ever “truly” efficient with respect to any type of information? The Efficiency Paradox denies the possibility of a fully efficient equilibrium. By contrast, our analysis in Section II of at least two of the capital market mechanisms—universally informed and professionally informed trading—explicitly pointed to reaching just such an efficient equilibrium at a pace contingent on the mechanism involved. Correctly understood, however, the conflict between these perspectives is more apparent than real.

The problem is best analyzed by returning to the evidence that a fully efficient equilibrium *does* exist for at least some types of information. Recall that a substantial body of empirical literature demonstrates that market prices efficiently reflect information about the past prices of securities—the studies that Fama originally described as weak form tests.²⁰⁰ These studies suggest that trading strategies based on manipulation of past price information cannot yield trading profits. Because information costs associated with this type of information are so low, its distribution is virtually universal, and we would expect the market to be efficient with respect to it. Moreover, because these results seem to hold up over

¹⁹⁹ See Grossman & Stiglitz, *supra* note 88, at 393; *supra* text accompanying notes 92-94.

²⁰⁰ See *supra* note 25.

extended periods of time, market efficiency does not appear to oscillate or "swing" with changing levels of returns from trade. But, if the market is stably efficient with respect to past price information, why would anyone make an investment, even a very small one, to acquire such information? What keeps the market efficient?

The explanation lies in the joint cost aspects of the use of the particular information in question. Positive costs, however small, incurred in gathering information about past prices would normally trigger the Efficiency Paradox unless traders unavoidably incur these costs as part of other investment strategies that *do* have the potential to yield them positive net returns. In this case, the market would not be efficient with respect to the other strategies, but would be efficient with respect to past price data. The return necessary to achieve "weak form efficiency" would come from the lure of the other strategies. Putting the point somewhat differently, the information about past prices behaves as if it were costless to the extent that the expenditure necessary to acquire and process this information is made for another purpose.²⁰¹ The market becomes completely efficient with respect to one form of information as a result of efforts to exploit inefficiency with respect to another.

A second example of the phenomenon of informationally efficient markets, this time dealing with a type of information commonly analyzed through semi-strong form tests, further clarifies our point. A large body of empirical literature tests the pricing effects of cosmetic accounting changes, such as the method of calculating depreciation or of accounting for an acquisition, that alter reported earnings but not real cash flow.²⁰² These studies uni-

²⁰¹ Of course, we do not suggest that traders must engage in chartist-type, "technical" analysis of past prices to make full use of their investment in other information. On the contrary, it is knowledge about the primary informational constituents of past prices that traders must carry forward in their efforts to acquire, process, or verify new information. To the extent that many, if not all, traders must keep abreast of the fundamental information underlying past prices in order to value new information properly, past price information behaves as if it were costless. Efficient market prices would require chartist-type technical research only to the extent that this could succeed where efforts to decode the informational constituents of past prices directly had failed. Thus far, of course, all evidence other than the continuing practice of technical analysis militates against its utility as a form of price decoding and supports traditional weak form price efficiency. See *supra* note 25.

²⁰² These studies are exhaustively reviewed in the surveys cited *supra* note 12.

formly show that the market processes such changes efficiently: it promptly and correctly evaluates them as meaningless. But how can prices efficiently reflect the information that a cosmetic accounting change does not alter firm value if no one can earn a return on investing in that information?

Again, the answer seems to us to depend on the cost of maintaining, rather than of first achieving, the efficient equilibrium. Assume an initial innovation: the discovery that cosmetic changes in reported earnings do not alter firm value. The empirical literature does not demonstrate that the originators of this insight failed to earn a return on their efforts. Rather, it is reasonable to suppose that they did earn an acceptable return on the information, but that the secret was subsequently dissipated through discovery by competitors (or even academics). So understood, the question posed by the Efficiency Paradox is not whether incentives exist to induce the *original* innovation.²⁰³ Rather, the puzzle is to explain how an efficient equilibrium is *maintained* once the innovation becomes so widely known that profit is no longer possible for those who exploit it.

Our answer is the same that we offered in the analysis of past price information. Because of joint cost characteristics, maintenance of the equilibrium is effectively costless, and the Efficiency Paradox disappears. The costs of maintaining an equilibrium are not the costs of discovery, but merely the costs of continuing to reflect a prior discovery in price. Just as with past price data, these costs are virtually zero, consistent with an efficient equilibrium, because of their joint characteristics. Traders reflect an accomplished innovation in their pricing evaluations as an inextricable part of their efforts to acquire or process other, still innovative, information.²⁰⁴

The importance of the joint cost characteristics suggests a more general insight: equilibrium analysis in the information market

²⁰³ This issue focuses on whether the market is allocatively, as opposed to informationally, efficient. See Rubinstein, *supra* note 30, at 820-23 (discussing informational efficiency).

²⁰⁴ In the case of past price information, traders can fully value new information about an individual security only through knowledge of the informational constituents of its old price. By contrast, where traders discover the "true" effects of a genre of accounting changes, they obtain information about the entire range of securities that are subject to these changes. In both instances, however, the costs involved are those of maintaining an informational equilibrium rather than of initial discovery.

must be considered in a dynamic context. The cost and return conditions necessary to induce the initial acquisition of new information are very different from the cost and return conditions necessary to maintain an efficient equilibrium with respect to that information *after* it has become widely distributed. It is the incentive to acquire new information and to develop new innovations that encourages the behavior necessary to maintain an efficient equilibrium with respect to prior information and innovations.

Our reconciliation of the conflict between empirical evidence suggesting the existence of efficient equilibria and the prediction of an absence of such equilibrium derived from the Efficiency Paradox also helps to interpret a substantial number of the empirical studies that have been used to test for the existence of market efficiency. Considering efficiency from the perspective of the costs of maintaining an equilibrium, studies finding that the market disregards cosmetic accounting changes may well not be semi-strong tests, as they are commonly described, but only a different type of weak form test. Both these studies and those considering the reflection in price of past price information investigate a common question: Is the market efficient when information costs are very low? For real evidence of semi-strong form efficiency, we would want to consider tests of the market response to new, and therefore more costly, information. Not surprisingly, here the evidence suggests some level of inefficiency, which is precisely what the Efficiency Paradox would predict.²⁰⁵

²⁰⁵ See, e.g., Bjerring, Lakonishok & Vermaelen, *Stock Prices and Financial Analysts' Recommendations*, 38 J. Fin. 187 (1983); Givoly & Lakonishok, *The Information Content of Financial Analysts' Forecasts of Earnings: Some Evidence on Semi-Strong Inefficiency*, 1 J. Acct. & Econ. 165 (1979); Watts, *Systematic 'Abnormal' Returns After Quarterly Earnings Announcements*, 6 J. Fin. Econ. 127 (1978) (abnormal returns not due to deficiencies in the capital asset pricing model are possible from quarterly earnings announcements, if direct transactions costs [use of a broker] can be avoided). These studies, which by and large rely on more frequent price observations than older tests of the ECMH, indicate small but significant deviations from semi-strong form price efficiency. Such deviations are precisely what we would expect where publicly-announced information is genuinely new and difficult to value, and where large numbers of traders consequently elect not to invest in valuation costs.

V. INSIDER TRADING, MANDATORY DISCLOSURE, AND THE DUAL MARKET SYNTHESIS

In the preceding section, we sought to demonstrate how our synthesis of the capital and information markets' operation provides insight into two theoretical puzzles: the investment banker's role in facilitating new financial products and the "Efficiency Paradox." Our analysis of those two theoretical puzzles was intended merely to illustrate—not exhaust—the explanatory potential of the dual market perspective. They were selected no less for their ability to demonstrate the disparate information market processes that operate in the high- and low-cost regions of the information cost continuum than for their intrinsic theoretical interest. In this section, we continue in much the same spirit by analyzing two policy problems—the regulation of insider trading and the mandatory character of disclosure under the Securities Exchange Act of 1934—to illustrate the value of our dual market synthesis as a framework for addressing policy issues in corporate and securities law. As in the previous section, these two issues are not the only ones that might profitably be addressed from the dual market perspective.²⁰⁶ They are, however, particularly useful illustrations for

²⁰⁶ While we cannot attempt an inventory of all the other issues whose resolution might be aided by our approach, some sense of their range may be suggested by two examples.

The first concerns the SEC's recent adoption, on a permanent basis, of shelf registration procedures in Rule 415. SEC Securities Act Release No. 6,499, 48 Fed. Reg. 52,889 (1983), reprinted in [Current Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 83,449 (Nov. 17, 1983). For the text of the new rule, see *id.* at 52,896, reprinted in 1 Fed. Sec. L. Rep. (CCH) ¶ 3,383 (Nov. 17, 1983) (to be codified at 17 C.F.R. § 230.415). One critical result of Rule 415 is to restructure the role of the underwriter in an important class of securities offerings. In contrast to the traditional pattern in which the underwriter is selected long before the pricing of the security and plays a central role in preparing the registration statement, see *supra* text accompanying notes 181-86, Rule 415 facilitates a form of offering commonly referred to as a "bought deal," in which the registration statement is prepared, filed, and declared effective prior to selection of the underwriter. See Banoff, *Regulatory Subsidies, Efficient Markets, and Shelf Registration: An Analysis of Rule 415*, 70 Va. L. Rev. 135, 148 (1984) ("bought deal"). The Rule 415 underwriter is selected only at the last moment prior to sale of the securities, and the selection is based largely on the amount bid for the securities by prospective underwriters. In such a transaction, of course, the underwriter cannot make any significant investigation of the issuer and, thus, cannot play its traditional role of policing disclosure by the issuer. See *supra* note 164.

This reduction in the underwriter's role has not been without controversy. The investment banking community has objected vigorously because the Rule has enlarged the area of explicit price competition between underwriters and, as a result, has substantially reduced the size of the underwriting spread in offerings in which the rule is used. See, e.g., Ehrbar,

two reasons. First, as in the case of the two theoretical puzzles considered in the preceding section, they concern information sets that have quite different cost characteristics. Inside information is extremely costly to everyone except the small group of insiders who have access to it. By contrast, the accounting data contained in SEC filings under the 1934 Act is widely distributed at little cost to recipients. Second, scholars have already extensively analyzed both issues using the tools of modern finance theory and, in particular, the now standard version of the ECMH. We believe that a dual market approach has fresh insights to offer to supplement those derived from a simple application of the tools of finance theory.

The two policy discussions that follow, then, are intended to demonstrate the utility of an analytical framework, not to provide exhaustive consideration of our target problems or to fix on definitive solutions. Indeed, it is precisely the simple solution offered by earlier commentators relying on finance theory, namely, complete or partial deregulation, that unifies the separate analyses of this

Upheaval in Investment Banking, *Fortune*, Aug. 23, 1982, at 90. Additionally, at least one member of the Securities and Exchange Commission, Commissioner Barbara Thomas, criticized the Rule because it reduces the underwriter's role in the disclosure process. SEC Securities Act Release No. 6,423, 47 Fed. Reg. 39,799, 39,803-09 (1982), reprinted in [1982 Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 83,250, at 85,284-88 (Sept. 2, 1982) (Commissioner Thomas dissenting to extension and amendment of Rule 415). See also SEC Securities Act Release No. 6,499, *supra*, at 52,897, reprinted in [Current Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 83,449, at 86,346-47 (Nov. 17, 1983) (Commissioner Thomas dissenting to permanent adoption of Rule 415). We believe that our approach to the underwriters' role in the distribution of securities, *supra* text accompanying notes 192-93, can be helpful both in sorting out the controversy and in developing appropriate limits on the application of the Rule. For example, it seems to us that both the objection to shrinking underwriting spreads and Commissioner Thomas' concern with the due diligence role of the underwriter are best evaluated from the perspective of the role of the underwriter as a reputational intermediary. Identifying the settings in which reputational services are not needed may not only explain why underwriting spreads are lower in these offerings, but may also provide the best approach to determining the appropriate breadth of the Rule's application.

A second area where a focus on the mechanisms of market efficiency can have significant policy implications is in evaluating the development of a national market system. See *supra* note 167. Our analysis of the relationship between information costs and market efficiency suggests that market structure has a substantial impact on the cost of information, and therefore on relative marketing efficiency. The empirical evidence is beginning to bear this out. See Sanger & McConnell, *Stock Exchange Listings, Firm Value and Security Market Efficiency: The Impact of NASDAQ*, (June 1983) (Working Paper) (prior to NASDAQ, OTC stocks earned positive abnormal returns on announcement of stock exchange listing; abnormal returns disappeared in post-NASDAQ period).

section. Thus, the deregulation of insider trading is often urged as one of the few reforms with any real promise of increasing the informational efficiency of securities prices.²⁰⁷ Similarly, deregulation of corporate disclosure requirements is frequently advocated as an appropriate response to evidence that mandatory disclosure has had little impact on the behavior of securities prices.²⁰⁸ We remain skeptical, however, of simple deregulation solutions in both cases. Our skepticism stems not from any great satisfaction with existing law. Rather, it results from a straightforward application of the dual market synthesis, which, we believe, establishes that the case for *entirely* deregulating insider trading is weak, and that the case against mandatory disclosure is far from convincing.

A. *The Insider Trading Debate*

Those who advocate relaxing the prohibitions against insider trading typically argue that such trading is not merely harmless, but is actually beneficial in a number of respects. Our particular concern here is the assertion that insider trading has desirable effects on the market price of the security being traded.²⁰⁹ For example, sell orders by insiders with unfavorable private information are said to drive the price of the security down toward its "true" value, the price at which it would trade if the inside information were disclosed. A buyer of the security thereby pays a lower and more accurate price than he or she would have paid in the absence of insider trading.²¹⁰ For our purposes, the argument's most interesting feature is its unstated assumption about the market dynamic by which insider trading alters the price of the security. It seems clear that the decline in price is generally believed to be caused by the increase in supply resulting from the insider's sell order. The problem, however, is that this critical assumption concerning the operative market dynamic is wrong.²¹¹

²⁰⁷ See *infra* text accompanying notes 209-10.

²⁰⁸ See *infra* text accompanying notes 225-26.

²⁰⁹ The argument that insider trading may actually be beneficial to uninformed investors originates with H. Manne, *Insider Trading and the Stock Market* (1966). Other claims on behalf of insider trading are discussed *infra* note 221.

²¹⁰ This argument necessarily assumes that the uninformed trader's decision to buy the security was not induced by the fall in the security price.

²¹¹ Carlton & Fischel, *The Regulation of Insider Trading*, 35 *Stan. L. Rev.* 857 (1983), do not make this mistake. Nevertheless, they offer a quite different policy recommendation

The error in this supply-based explanation for the price effect of insider trading lies in its misspecification of the relevant supply. Capital asset pricing theory teaches that a security represents only a particular combination of expected return and systematic risk, for which there is a vast number of substitutes. Thus, the relevant supply for purposes of determining the impact of insider trading is not the "float" in the particular security, but rather the total of all other investment opportunities with a similar relationship between risk and return.²¹² The increase in the correctly specified supply caused by an insider's sell order is simply too small to have any but a transitory, and probably insignificant, impact on the price of the security.²¹³

Our approach to the concept of market efficiency and the capital market mechanisms that underlie it allows us to identify the manner in which insider trading alters security prices. The price of a security changes as a result of new information that alters investors' expectations about the security's risk and return.²¹⁴ Insiders trade because private information alters their expectations. But their trading will change the *market's* expectations about the security, and hence its price, only if their private information is somehow transmitted to the market. Thus, the price effect of insider trading is an example of what we have called the derivatively informed trading mechanism.²¹⁵ As a result of price or trade decod-

than we do. Cf. *infra* note 224.

It is unclear which mechanism Manne originally believed was responsible for the reflection of inside information in price. At times he implies, as we argue, that the critical factor is the distribution of the information, H. Manne, *supra* note 209, at 82-83. At other times, however, he seems to believe that a supply effect is responsible. *Id.* at 80. In a later work that has not received the attention it deserves, Manne stresses the importance of the informational explanation and acknowledges that the supply effect was overemphasized in his original work. H. Manne, *Economic Aspects of Required Disclosure under Federal Securities Laws, in Wall Street in Transition* 21, 74-79 (Manne & Solomon eds. 1974).

²¹² The ability of an investor to alter the risk of a security by borrowing to purchase it further increases the supply of fungible investments.

²¹³ See R. Brealey, *supra* note 65, at 35-44; Scholes, *supra* note 67. Easterbrook, *supra* note 8, at 335-36, makes a similar point. For a related discussion, see also *supra* note 67 and text accompanying notes 78-80 (Scholes study and price effects).

²¹⁴ This is the disequilibrium role of information described *supra* text accompanying notes 38-39.

²¹⁵ See *supra* text accompanying notes 73-95. This observation assumes, of course, that the number of insiders is not large enough to alter price through "weak learning." See *supra* note 84. In the latter case, insider trading begins to meld with the operation of the professionally informed trading mechanism. See *supra* note 67.

ing²¹⁶—deducing the content of private information from transitory price fluctuations or the identity of traders—the market “learns” the relevance of the insiders’ private information from their own trading activity, and the price of the security changes to reflect the market’s new information.²¹⁷

Identifying the mechanism that underlies the price effects of insider trading is critical because it focuses attention on the relative efficiency of these price adjustments. Comparatively speaking, derivatively informed trading is an inefficient capital market mechanism. Insider trading, then, often causes prices to move in the “right” direction, just as proponents of deregulation argue. But because derivatively informed trading functions slowly and sometimes only sporadically, encouraging it is unlikely to have much effect on the efficiency of securities prices. If we stipulate for the moment that our sole concern is market efficiency, it hardly follows that deregulating insider trading without more is the most promising of possible reforms. The critical policy question is not whether to permit insider trading, but whether the derivatively informed trading mechanism can be made to operate more efficiently.

Consider how a discussion of insider trading might proceed if it selected market efficiency as its chief aim and built upon analysis of the derivatively informed trading mechanism. Recall that price decoding, the chief source of the price effects of insider trading, is also a poor transmitter of derivative information in comparison to trade decoding. Minor fluctuations in price and volume are inherently ambiguous or subject to noise; observations on the activity of individual traders are much more informative. It follows that the greater the number of uninformed traders who are able to learn the identity of insider traders, the size of their trades, and other derivative information, the more effectively the derivatively in-

²¹⁶ See *supra* text accompanying notes 77-95.

²¹⁷ See *supra* text accompanying note 80. Price and trade decoding are complementary processes. Among other interactions, trade decoding—by traders who are both aware of the initial insider trading and can draw the necessary inferences from that fact—causes the price of the security to change. This triggers price decoding by other traders who lack the information required for successful trade decoding. Of course, if the fact that insiders are trading is truly kept secret, and if the transitory price effects are too small to facilitate price decoding, the inside information may not be reflected in price until it is actually discovered or disclosed.

formed trading mechanism will operate and the greater will be the market's relative efficiency with respect to the inside information. Thus, making the derivatively informed trading mechanism more effective requires wider distribution of the information on which the critical deductions are based, and the issue becomes how to disclose the fact that insiders are trading and the size of the trades.²¹⁸ But while certain insiders are currently required by Section 16(a) of the Securities Exchange Act to disclose their trading,²¹⁹ disclosure is required only some ten to forty days after the trade,²²⁰ hardly an aid to efficient operation of the derivatively informed trading mechanism. Understanding the mechanism by which insider trading alters market price thus suggests that a serious argument for lifting the prohibition on insider trading based on information effects must also consider a recommendation that the insider be required to disclose, at some period before trading, his identity and the size of the intended trade.²²¹

²¹⁸ It is important to distinguish this disclosure from disclosure of the inside information itself. Although disclosure of the inside information would achieve full informational efficiency, it would also alter the incentives to create the information in the first place, thereby raising questions of allocational efficiency. See, e.g., Hirschliefer & Riley, *supra* note 39, at 1404-06 (altering incentives to promote more efficient use of information will tend to reduce incentives to produce information). To be sure, any increase in informational efficiency from insider trading may alter the incentives to create the information because it reduces the opportunity to exploit informational disparities through trading. Because the derivatively informed trading mechanism does not disclose the information itself, however, it will not reduce the returns to information creators who exploit their information through production rather than trading, and concern over an impact on allocation is thereby minimized. *Id.* A reduction in return to trading is principally important with respect to the use of insider trading as a form of management compensation. We consider this *infra* note 221.

²¹⁹ Trading on inside information, however, remains illegal under current law.

²²⁰ Section 16(a), 15 U.S.C. § 78p(a) (1982), requires that an insider file a report of his trading with the SEC within ten days after the trade and within ten days after the close of the calendar month in which trading occurs.

²²¹ Some precedent for this type of regulation, and a rough indication of how such disclosure might work, may be found in the rules governing the required filing of Form 144 prior to the sale of restricted securities. See generally D. Goldwasser, *A Guide to Rule 144* (2d ed. 1978); Fogelson, *Rule 144—A Summary Review*, 37 *Bus. Law.* 1519 (1982).

Our policy recommendation is not, however, without objection even on its own terms. Another common justification for insider trading, also originating with Henry Manne, is that it represents a form of compensation bargained for by insiders. H. Manne, *supra* note 209, at 138-41. According to this view, prohibition of insider trading simply shifts the form but not the amount of managerial compensation—a result that, without more, hardly seems worth the cost. And while our requirement of pre-trade disclosure does not *prohibit* insider trading, it would tend to reduce the profit available from such trading precisely because the derivatively informed trading mechanism would be more efficient. Thus, the increase in in-

Our focus on creating institutional arrangements that increase the effectiveness of the relevant capital market mechanism parallels the conclusions recently reported by Plott and Sunder following their examination of the performance of experimental securities markets in a laboratory environment.²²² In most of the experimental markets tested, a fraction of the traders were given information that the other traders lacked. Thus, the experiments tested, in part, the operation of the derivatively informed trading

formational efficiency from disclosure comes at the cost of an arguably unnecessary shift in the form of managerial compensation. This is not the place to evaluate the overall desirability of insider trading, but even a brief consideration suggests that restricting the use of insider trading as a form of management compensation may be beneficial in itself.

One concern is the relative lack of effective market checks on the payment of excessive compensation through insider trading as compared to more traditional methods. Because excessive insider trading does not alter the firm's cash flows, it need not affect firm performance in the product or capital market in ways that will significantly constrain managerial self-interest. Nor would the market for corporate control pose a sufficient check. If a target's managers earn excessive compensation by insider trading, its attraction to potential acquirors may rest in part on the possibility that *their* managers stand to gain the same opportunity after acquisition. Eliminating insider trading might benefit the shareholders through an increase in share price, but the acquiring company managers, by foregoing the opportunity for insider trading, would bear the entire cost. Thus, for this purpose, the market for corporate control may operate only to shift the opportunity for excessive compensation between managers, rather than to eliminate it. Reinforcing the lack of market checks on insider trading is the difficulty of monitoring such trading. Although more traditional methods of compensation necessarily appear in the accounting records of the firm, levels of insider trading cannot easily be determined for precisely the same reasons that prevent effective enforcement of the current prohibition. See Dooley, *Enforcement of Insider Trading Restrictions*, 66 Va. L. Rev. 1 (1980).

In addition to the greater potential for excessive payments, the use of insider trading as a method of compensation also raises problems of perverse incentives. The literature on insider trading has long recognized that incentives concerning whether and when to disclose new company information may be affected by the opportunity for insiders to trade before disclosure. But the availability of insider trading also has a perverse effect on managers' risk preferences in connection with firm investments. Giving managers the right to trade on inside information, even if only on positive information, has the effect of giving them an option that will be exercised only if positive information is produced. We know, however, that the value of an option increases as the risk of the company's business—the variability of return—increases. Thus, managers who can trade on inside information have an incentive to increase the risk of the business by making more risky investments. This is not so troublesome in itself as it might, however, balance the risk aversion resulting from the managers' undiversified human capital investment in the firm. The problem, however, is that the incentive extends to making negative net present value investments: investments for which the increase in risk is not matched by a commensurate increase in expected return. In this setting, managers share in the gain if the risky investments pay off, but the shareholders bear all of the cost if they do not.

²²² Plott & Sunder, *Efficiency of Experimental Security Markets with Insider Information: An Application of Rational-Expectations Models*, 90 J. Pol. Econ. 663 (1982).

mechanism that has structured our discussion of the informational role of insider trading. The results of the experiments led Plott and Sunder to the following conclusion, in which we find important support for both our overall approach and our specific policy recommendation:

[D]iscussion of bids, offers, trader identification, and other endogenous sources of information suggests that the trading institutions themselves may be important in determining the applicability of the [rational expectations, i.e., efficient markets] models. Institutions can dictate the type of information available to participants. For example, a computerized market which masks bids, offers, and *trader identity* or even volume may not operate as efficiently as one which does not.²²³

In the end, our point is not to resolve the desirability of insider trading here.²²⁴ We do believe, however, that the perspective gained from our analysis of the mechanisms of market efficiency sheds substantial light on the appropriate approach to the problem. And that, after all, is precisely our point.

²²³ Id. at 690 (emphasis added).

²²⁴ Informational efficiency is not itself enough to justify lifting the prohibition on insider trading. If insiders are allowed to trade on private information, outside investors will be systematically disadvantaged through a decrease in their expected return. As Kenneth Scott has pointed out, investors will not play in a game in which the odds have been changed unfavorably without a commensurate increase in payoff. Scott, *Insider Trading: Rule 10b-5, Disclosure and Corporate Privacy*, 9 J. Legal Stud. 801, 808 (1980). Thus, while insider trading may have no distributional impact, which was Professor Scott's point, it will increase the cost of capital. The question then becomes whether this cost is offset by the value of compensating managers through insider trading. As our prior comments indicate, see *supra* note 221, we doubt that it is. A company can achieve all of the benefits of insider trading through incentive plans keyed to stock prices or other measures of firm performance. Moreover, such plans avoid the monitoring problems associated with insider trading. Indeed, we believe that it is in fact the high cost of monitoring insider trading that answers the rhetorical question commonly put as an argument in favor of insider trading: If insider trading is actually detrimental to companies, why do we see so few private contracts prohibiting it? See, e.g., Carlton & Fischel, *supra* note 211; Dooley, *supra* note 221, at 48-49. If effective monitoring requires computerized surveillance of the entire trading market, see Noble, *How the S.E.C. Watches Stocks*, N.Y. Times, Apr. 13, 1984, at D1, col. 4, free rider analysis would counsel in favor of collective monitoring and enforcement—i.e., a legally imposed prohibition. For a careful and sophisticated exposition of the opposite perspective, see Carlton & Fischel, *supra* note 211.

B. The 1934 Act Mandatory Disclosure Debate

Proponents of abandoning or curtailing the duty to file disclosure reports under the Securities Exchange Act²²⁵ join critics of insider trading prohibitions in preferring an unregulated information market to the current regulatory regime. Unlike the critics of insider trading rules, however, the proponents of relaxing mandatory disclosure do not argue that deregulation will increase the informational efficiency of prices; rather, they argue only that it will decrease issuer filing costs while leaving the amount and quality of information largely unaffected.²²⁶ Disclosure under the 1934 Act is said to be an unsuccessful attempt to collectivize information costs. An unregulated information market would result in dissemination of much the same information to traders at lower cost.

Expressed in such general terms, this conclusion is extremely difficult to evaluate, not only because of the empirical uncertainties surrounding the costs and benefits of 1934 Act disclosure, but also because these variables themselves depend on the particular disclosure that is required.²²⁷ For our purposes, however, a final verdict on mandatory disclosure is of less interest than a single key assumption that shapes the terms of the debate: the belief that whether mandatory disclosure successfully economizes on information costs can be determined on the basis of the behavior of securities prices. This assumption structures the evidence deployed by

²²⁵ Section 13 of the Securities Exchange Act of 1934, 15 U.S.C. § 78m (1982), currently requires all publicly-held corporations having a class of securities listed on a national securities exchange, or having 500 shareholders and \$1,000,000 in assets, to file annual Form 10-K reports, quarterly Form 10-Q reports, and periodic Form 8-K reports. Form 10-K includes certified financial statements and certain other qualitative information specified in Regulation S-K; Form 10-Q chiefly requires abbreviated quarterly accounting data; and Form 8-K, which must be filed 15 days after the occurrence of certain materially important corporate events, requires a brief description of the triggering event. For examples of Forms 10-Q, 10-K, and 8-K, see 6 R. Shapiro, A. Sachs, & C. Olander, *supra* note 186, Forms 1-29 to 1-31, at 1-300 to 1-349.

²²⁶ E.g., H. Kripke, *supra* note 1, at 106-39; S. Phillips & J. Zecher, *supra* note 150, at 27-51; Benston, *Required Disclosure and the Stock Market: An Evaluation of the Securities Exchange Act of 1934*, 63 Am. Econ. Rev. 132 (1973).

²²⁷ For example, one of the chief consequences of the recent Advisory Committee Report, *supra* note 3, was to move the Commission toward a more permissive position on the voluntary disclosure of "soft," or forecast, information. The Commission's reluctance to allow, let alone require, disclosure of this type of information has been a significant element in some of the arguments directed against the cost-effectiveness of mandated disclosure. See, e.g., H. Kripke, *supra* note 1, at 106-39.

both critics and supporters of the 1934 Act in two important ways. It does so initially in the weight assigned to semi-strong form ECMH tests demonstrating that prices reflect most of the informational content of 1934 Act filings *before* the forms are actually filed.²²⁸ It also does so in the significance attached to time series data, gathered by George Benston, on the behavior of securities prices before and after the passage of the 1934 Act.²²⁹ Because the assumption is particularly central to Benston's analysis, we examine it in the context of his work.

In brief, Benston compared the behavior of stock prices before and after the passage of the 1934 Act for two groups of corporations listed on the New York Stock Exchange: firms that voluntarily disclosed their sales figures prior to the 1934 Act, and firms that disclosed their sales only after the 1934 Act made disclosure mandatory.²³⁰ Using the now standard cumulative abnormal return methodology to control for the effect of market-wide influences on stock prices, Benston found that the differential impact of mandatory disclosure of sales data on the two groups did not result in differential effects on their share prices. Specifically, neither

²²⁸ See, e.g., Benston, *supra* note 226, at 137-41 (critical of disclosure); Friend & Westerfield, *Required Disclosure and the Stock Market: Comment*, 65 *Am. Econ. Rev.* 467, 467-70 (1975) (supporting disclosure).

²²⁹ Benston, *supra* note 226, at 141-53. For critical discussion of the Benston study, see Friend & Westerfield, *supra* note 228, and Benston's reply, *Required Disclosure and the Stock Market: Rejoinder*, 65 *Am. Econ. Rev.* 473 (1975). See also Seligman, *The Historical Need for a Mandatory Corporate Disclosure System*, 9 *J. Corp. L.* 1 (1983). The Benston study occupies a central position in recent securities scholarship because it is the first and most influential time series analysis of the effects of the 1934 Act. More recent scholarship continues to probe time series data for possible effects of the 1934 Act on securities returns, but it has not thus far altered the key terms of the debate between Benston and his critics. See, e.g., Ingram & Chowning, *The Effect of Financial Disclosure Regulation on Security Market Behavior*, 58 *Acct. Rev.* 562 (1983) (observing temporal shift in securities returns associated with passage of the 1934 Act); Chow, *The Impacts of Accounting Regulation on Bondholder and Shareholder Wealth: The Case of the Securities Acts*, 58 *Acct. Rev.* 485 (1983) (rejecting hypothesis that 1934 Act redistributed wealth between shareholders and bondholders).

The Securities Act of 1933, which imposes mandatory disclosure in connection with the issuance of new securities, has also been the subject of several time series studies, beginning with the pioneering investigation by Stigler, *Public Regulation of the Securities Markets*, 37 *J. Bus.* 117 (1964). See also Jarrell, *The Economic Effects of Federal Regulation of the Market for New Security Issues*, 24 *J.L. & Econ.* 613 (1981). Although these studies reach conclusions similar to Benston's, we leave discussion of the 1933 Act for another day in light of the comparatively greater institutional complexity of new issue disclosure.

²³⁰ Benston, *supra* note 226, at 142.

group showed significant changes in its aggregate rate of return to investors after the passage of the Act,²³¹ there were no significant differences in the Act's effects on the volatility of stock prices between the two groups,²³² and following mandatory disclosure no significant differences emerged in the sensitivity of the two groups' stock prices to market-wide, systematic influences.²³³ Largely on the basis of these results, Benston argued that the financial data generated by 1934 Act filings were of little value to investors, and that, therefore, "[t]here appears to have been little basis for the [1934] legislation and no evidence that it was needed or desirable."²³⁴

Yet both this conclusion and the voluminous debate that it has triggered presume that any positive effects resulting from 1934 Act

²³¹ More precisely, Benston's examination of the performance of the stock of disclosure and nondisclosure firms following passage of the Act revealed that neither group of stocks earned significant cumulative abnormal returns during the transition period when 1934 Act disclosure was implemented. *Id.* at 147-48. This methodology aggregates the extent to which the monthly returns for each stock differed from that predicted by an optimal measure of the stock's sensitivity to systematic, market-wide influences on price. Recall that the capital asset pricing model postulates that share prices are a linear function of systematic risk. The "normal" returns on a security, therefore, will be randomly distributed around expected returns that are calculated on the basis of the security's distinctive sensitivity to market-wide price changes (the security's "beta"). Benston, in effect, showed that returns on both the disclosure and the non-disclosure securities remained "normal" during the start-up of disclosure, suggesting that the onset of mandatory disclosure of sales data had no unanticipated impact. If, alternatively, managers of nondisclosing firms had withheld sales information prior to mandatory disclosure in order to deceive the market about the riskiness of their firms, the onset of mandatory disclosure might have been expected to result in negative abnormal returns as the market reflected the previously unanticipated bad news. See *id.* at 144.

²³² "Price volatility" here refers to the variance in a stock's prices that could not be predicted by each stock's characteristic sensitivity to market-wide price influences ("beta"). Presumably the release of previously undisclosed information about the non-disclosing firms might either increase or decrease price volatility. Benston, for example, speculated that disclosure of unanticipated information might increase price volatility if it misled traders to underestimate the unsystematic risk of securities. Benston, *supra* note 226, at 144. By contrast, wider distribution of information as a result of mandatory disclosure might decrease price volatility because it would trigger more effective capital market mechanisms. In fact, Benston found no significant differences in volatility between the securities of disclosing and non-disclosing firms. *Id.* at 141-49.

²³³ "Market-wide systematic influences on price" refers here to each individual security's "beta." See *supra* note 228. Newly-disclosed information might be expected to alter a stock's beta if it led to revised expectations about the stock's sensitivity to market-wide economic influences. Benston, *supra* note 226, at 144.

²³⁴ *Id.* at 153.

disclosure *must* register in price behavior.²³⁵ Our analysis of the capital and information markets leads us to conclude that this is not the case. Although a positive price response to the 1934 Act would confirm that informational benefits flow from mandatory disclosure,²³⁶ an absence of price response can tell us very little about the Act's actual effect. The reason is simple. Unless the information to be disclosed under the 1934 Act was either very costly or wholly unavailable to the market before the Act, we would not expect the Act to have any immediate effect on securities prices because the capital market efficiency mechanisms are likely to have caused the information to be reflected in price even before the Act's passage. This alone, however, does not establish that the 1934 Act was without benefit. Mandatory disclosure might still have created substantial savings for informed traders by collectivizing some of the costs of acquiring, processing, and verifying information that traders had independently expended prior to the Act's passage. In short, a plausible explanation of the effects of the 1934 Act is that it increased the *net* returns to informed traders rather than their gross returns, through savings on investment in information rather than through increases in trading profits. Any such net gain would not have been reflected in Benston's analysis.

This observation leads us to a simple hypothesis about which market participants benefited most from mandatory disclosure. In 1934 as well as today, the most likely potential winners from such disclosure were, and are, members of the professional trading community. Assuming that prices prior to 1934 efficiently reflected sales data, and quite possibly all other information that was subsequently disseminated through 1934 Act filings, the market mechanism most likely to be responsible for such a high degree of relative efficiency in pre-Act prices must have been professionally

²³⁵ Quite remarkably, neither Benston nor his critics have thus far considered why this should be so; that is, they have not explained why we should always expect even major information cost savings to generate less volatile or more "honest" securities prices. See I. Friend, *Economic and Equity Aspects of Securities Regulations 19-27* (University of Pennsylvania, Wharton School Working Paper No. 7-82) (June 1982); N. Gonedes & N. Dopuch, *Capital Market Equilibrium, Information Production, and Selecting Accounting Techniques: Theoretical Framework and Review of Empirical Work*, in *Studies on Financial Accounting Objectives*: 1974, at 48, 93-96 (1974).

²³⁶ Benston's focus on sales disclosure, see *supra* text accompanying note 230, does not preclude the possibility that other information made available by mandatory disclosure might have affected securities prices.

informed trading. To be sure, professionally informed trading was doubtlessly assisted by derivatively informed and uninformed trading.²³⁷ Moreover, the professionals of 1934 were less specialized and sophisticated than today's professionals; they undoubtedly viewed themselves as members of the Wall Street "club" rather than as analysts of securities. Nonetheless, prior to 1934, the professional community could have succeeded in acquiring or surmising the information that the Act subsequently required issuers to file, at least for accounting items as important as sales and for firms large enough to be listed on the NYSE.

The crucial difference between the pre-Act and the post-Act periods, then, would only have been one of cost. After the Act, the *same* information that Wall Street traders had always acquired would simply have become cheaper to obtain, process and verify.²³⁸ From this perspective, the Act's passage is analogous to the introduction of a new piece of hardware—for example, a new computer—that reduces the costs to traders of processing information. The first professional trader to acquire such a device would increase his net earnings, because the new computer would enable him to process the same amount of trading information at a lower cost. Indeed, even if all professional traders acquired computers, each would increase his or her net earnings because lower processing costs would add to the net returns of the entire community of professional traders. Only when the higher profits attracted additional competition in the form of new entrants would the earnings of *individual* traders return to their pre-innovation levels.²³⁹ In principle, there is no difference between this computer hypotheti-

²³⁷ See *supra* text accompanying notes 73-123 (derivatively informed and uninformed trading mechanisms). The absence of significant differences in price behavior between "disclosure" and "nondisclosure" stocks in the periods before and after passage of the Act suggests the importance of professionally informed trading. Not only would derivatively informed and uninformed trading presumably have resulted in less efficient aggregate prices for the nondisclosure stocks prior to 1934, but they would also have generated greater volatility for these shares. See *supra* note 119.

²³⁸ Benston has recently acknowledged the potential for SEC administration of 1934 Act disclosure to reduce the information costs of market professionals. See G. Benston, *Corporate Financial Disclosure in the UK and the USA 169-70* (1976).

²³⁹ This prospect assumes an absence of entry barriers. Note also that when higher net returns to brokers and other professional traders are "competed away," the net returns to lay investors who use the services of these professionals will increase, ultimately resulting in an increase in securities prices. Any such delayed price effect, however, will be extremely gradual, and thus quite unlike the sharp price impact anticipated by Benston's analysis.

cal and the imposition in 1934 of mandatory disclosure, except that issuers rather than traders bear the information costs under a mandatory disclosure system, and therefore the ultimate efficiency of the system depends on whether collectivization actually results in a reduction in overall information costs.²⁴⁰

We conclude that the disclosure provisions of the 1934 Act may have initially operated—whatever the beliefs of its proponents and critics—as a form of relief legislation for professional traders, with little or no immediate value to issuers or to the ostensible beneficiaries of the Act, the uninformed investing public.²⁴¹ Of course, we cannot say whether the potential savings in information cost conferred on the market professionals of 1934 were significant, still less whether they outweighed the disclosure costs imposed on issuers by the Act.²⁴² Moreover, even if we knew the answers to these questions, the dual market perspective suggests that they would have little relevance for the debate over mandatory disclosure *today*. The information market infrastructure has evolved dramatically since 1934 in ways that arguably might either diminish or en-

²⁴⁰ This seems plausible because issuers are the lowest cost producers of such information, and collectivization of production eliminates the costs of repetitive production.

²⁴¹ This observation about the 1934 Act disclosure system's beneficiaries is less surprising than it may at first appear, given Wall Street's heated opposition to the Act. See J. Seligman, *The Transformation of Wall Street* 85-99 (1982). Such opposition, however, came largely from a coalition of lead underwriters and major issuers. *Id.* In the 1930's, specialized trading interests still lacked an independent political voice. By 1964, however, security analysts and other trading professionals had gained independent clout, and they enthusiastically welcomed the Securities Acts Amendments of 1964, Pub. L. No. 88-467, 78 Stat. 565 (1964). These amendments expanded the coverage of mandatory disclosure from exchange-traded securities to most over-the-counter stocks as well. J. Seligman, *supra*, at 311-12.

Note that we make no claims about the conscious intentions of the Act's drafters and supporters, or about the potential indirect benefits of a vigorous professional trading community for lay investors or the public at large. Cf. *supra* note 239 (possibility of delayed impact on securities prices). Our only observation is that market professionals rather than lay investors stood to gain in the first instance from 1934 Act mandatory disclosure, and they apparently believe that they have. See *supra* text accompanying notes 61-63 (security analysts are end users of disclosure documents).

²⁴² Conceivably a time series study of, for example, returns to brokerage houses during the 1930's might shed light on the extent of cost savings to market professionals. The credibility of this approach, however, may be compromised by the likely effects of the Great Depression on trading income. A more promising approach might be to compare the net trading returns before and after the Act of two groups of brokers: those with low cost access to undisclosed information and those without such access. Our hypothesis would predict that the disparity between these two groups would diminish after the Act's passage.

hance the gross informational benefits of mandatory disclosure.²⁴³ Perhaps the only circumstance that has remained unchanged since 1934 is that market professionals are the primary potential beneficiaries of mandatory disclosure. This accounts in part, we suspect, for the overwhelming support that the securities industry gave expansion of the disclosure system in 1964,²⁴⁴ as well as for the generally high esteem in which the industry holds most SEC disclosure activities.

If our hypothesis is correct, there may not be any accurate method to ascertain the gross benefits of mandatory disclosure today other than by abandoning some or all of the disclosure system and observing the long-term effects on the information acquisition costs of market professionals. Short of such Draconian surgery, something might be learned through careful institutional studies of how securities analysts actually employ 1934 Act disclosure data. Yet even this type of research, while potentially illuminating, would be deficient in two respects: one would still not know the extent to which issuers would provide equally credible information if mandatory disclosure were abandoned; and one would not know the extent to which filing obligations serve *ex ante* to verify information already released to market professionals through less formal channels. Ironically, Benston himself noted the latter point²⁴⁵ in acknowledging the limited utility of semi-strong form test data:

²⁴³ A variety of factors, including the increase in size of the professional trading community, the impact of computer technology and new techniques in securities analysis, and a greater willingness on the part of issuers voluntarily to disclose information, suggest that mandatory disclosure may accomplish significantly less today than it did in the 1930's. See, e.g., H. Kripke, *supra* note 1, at 117-33. On the other hand, the far broader coverage of mandatory disclosure today, with over 10,000 firms required to report as compared to a few hundred in the 1930's, and the fact that securities analysts are able to follow closely only a fraction of all reporting firms, suggest that the beneficial effects of disclosure may actually be greater today than in the earlier period. See Advisory Committee Report, *supra* note 3, at XVIII-XIX, 91-92 (1,000 of 10,000 reporting companies followed by analysts). But see H. Kripke, *supra* note 1, at 126-28 (Advisory Committee figures too low; small companies either want to attract analyst attention or support too little trading activity to justify disclosure).

²⁴⁴ See *supra* note 241.

²⁴⁵ Benston and other critics of mandatory disclosure have also considered the prospect that the unregulated market would force voluntary disclosure at levels comparable to today's levels of mandatory disclosure. See, e.g., H. Kripke, *supra* note 1, at 126-68; Benston, Required Periodic Disclosure Under the Securities Acts and the Proposed Federal Securities Code, 33 U. Miami L. Rev. 1471 (1979); Grossman, *supra* note 154; Verrecchia, Discretionary Disclosure (August, 1983) (Working Paper No. 101, Center for Research in Security Prices).

Even though the [test] evidence reviewed does indicate that the financial reports required by the SEC, when made available, have almost no information content, this does not prove that the required disclosure is not valuable to investors. One might argue that the statements provide a confirmation of data previously released. Because investors know that a corporation's sales, operating expenses, extraordinary gains and losses, assets and liabilities will be reported, they may have some assurance that the preliminary reports, press releases, etc., are not prevarications.²⁴⁶

Benston comes very close to acknowledging that the amount and character of available information depends on the complex continuous variable of cost, rather than on the dichotomous circumstance of whether or not disclosure is mandated. But he rejects this insight in his later conclusion that the 1934 Act had no economizing effects at all. By contrast, if mandatory disclosure is viewed through the lens of a theory of efficiency mechanisms that operate in both the capital and the information markets, the inconclusive implications of Benston's findings emerge clearly.

As the preceding discussion indicates, however, the dual market perspective does not simplify policy analysis of mandatory disclosure any more than it leads to definitive recommendations about the proper regulation of insider trading. In both cases, the net effect of our analysis is to complicate policy considerations with new sources of potential cost and benefit and new possibilities for regulatory innovation. We believe, however, that these complications are a small price to pay for an analytical framework that places policy discussion on a firm theoretical footing.

VI. CONCLUSION

The nature and extent of informational efficiency in the capital market has been a focus of academic inquiry for at least twenty-five years now. Although for much of that period research efforts have focused primarily on empirical testing, more recent work has turned toward providing a cogent theoretical account of the processes by which new information is reflected in price. Our own efforts to explain how the capital and information markets jointly operate to determine the relative efficiency of securities prices is in

²⁴⁶ Benston, *supra* note 226, at 141. From a dual market perspective, assurances against issuer "prevarication" are merely devices for reducing verification costs.

part an illustration of this shift in emphasis and in part an attempt to offer an analytical synthesis of its achievements thus far. At this point, however, it is tempting to step back from our focus on the capital market and consider briefly whether our analysis has explanatory value beyond the specialized world of securities traders. Markets, after all, are pervasive phenomena; they mediate the allocation of far more than capital. Moreover, the extent of informational efficiency is surely a central determinant of the pricing behavior and institutional underpinnings of all markets, and not merely of the securities markets. Our analysis, then, is only part of a broader inquiry into the functioning of markets in general. That inquiry, stated generically, examines the joint interaction of product or service markets and the associated markets in information about the product or service.

Conclusions are an appropriate place for optimism. We are convinced, at least at this preliminary stage, that a continuum of market mechanisms keyed to the broad or narrow distribution of trading information is a general analytical tool with value for understanding a wide spectrum both of markets and of their attendant institutional supports.²⁴⁷

²⁴⁷ Consider how the dual market perspective, with its focus on the reduction of information costs, might inform inquiry into the behavior of such otherwise idiosyncratic markets as that for the sale of residential real estate. The real estate market, like the capital market, has specialized institutional actors whose roles, at least superficially, are quite unlike any we have considered thus far. Nevertheless, even these seem susceptible to better understanding through examination of their efforts to economize on information costs. Real estate brokers, for example, collectivize the costs of acquiring information because they are repeat players in a market where the principal traders are single transactions novices. Professional brokers also serve in a capacity akin to that of professional traders in securities markets in that they "police" housing prices. Brokers are driven not by the lure of arbitrage profits, as in the securities markets, but rather by the incentive to maximize their own commissions by setting the price of housing neither so low as to forego income nor so high that a house will not sell. In this sense, real estate brokers play an advisory role that grows out of the informational asymmetry between broker and seller as a result of differential information costs that Baron and Holmstrom have identified for investment bankers in the capital market. See Baron & Holmstrom, *supra* note 195.

A second example of an information cost perspective on the real estate market involves verification, rather than acquisition costs. We would expect the costs of *verifying* information to be quite high in the real estate market if either buyers or sellers were to attempt to resolve verification costs individually. Sellers have a powerful incentive to behave opportunistically in a one-shot, high-stakes transaction, and the very fact that the seller does not engage in recurrent sales precludes the use of reputation or other bonding devices as means of reducing verification costs. These considerations, together with the economies of scale that result from the specialized use of human capital, suggest that the real estate market

would prove fertile ground for the development of third-party informational experts akin to accountants in the capital market. This expectation is confirmed by the common use of expert pest control and structural inspections as part of the real estate transaction. In turn, the availability of such low cost verification techniques, as well as the easily observable nature of the facts subject to verification, may explain why real estate brokers, despite substantial efforts directed at building a reputation for professionalism and integrity, do not function as reputational intermediaries the same way that investment bankers do in the securities market. See *supra* text accompanying notes 189-93. In the real estate market less costly verification techniques dominate.

We may also speculate as to the particular market mechanisms that operate in the market for residential real estate. One would expect to find processes resembling both universally informed trading and professionally informed trading, the latter largely because of the professional broker's pricing function. But it is unlikely that derivatively informed trading plays a significant role, because most trading information that bears on price in the real estate market is asset specific. Such information is of value only to the pricing of a single house that enters the market very infrequently. The seller, then, is always in the position of an insider with information that the buyer is unlikely to discover through the market itself. This apparent failure of a market mechanism to reflect information in price is ameliorated, however, by the relative ease with which buyers can independently duplicate the seller's inside information. Because that information most likely bears on the physical condition of the house, it can be independently acquired and verified at modest expense through first-hand or expert inspection. And when the seller does know of a latent condition that inspection would not reveal, the law collectivizes verification costs by imposing on the seller a legal duty to disclose and backing that duty with a buyer's remedy for fraud. See J. Calamari & J. Perillo, *The Law of Contracts* § 9-20, at 289-90 (2d ed. 1977) (general rule is that seller of land is under obligation to disclose latent defects). In short, information costs are not as high as one might initially expect and derivatively informed trading is not necessary.