

# FRAUD ON THE MARKET MEETS BEHAVIORAL FINANCE

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## ABSTRACT

*The efficient market hypothesis, in its current form, dates academically from 1970. It was first accepted by a federal court in a shareholder class action in 1975, providing plaintiffs with a rebuttable presumption of reliance based on the fraud-on-the-market theory. By 1988, the fraud-on-the-market theory was the law in most circuits and was affirmed by the Supreme Court in Basic v. Levinson. Since then, the efficient market hypothesis has not been rebutted in any case involving actively traded securities, and its impact on securities litigation and regulation extends well beyond class certification to materiality, causation and damages. Somewhat ironically, over the same time period, financial economics was finding anomalies in securities markets that were not consistent with the Supreme Court's version of the efficient market hypothesis and using concepts borrowed from behavioral economics to develop theories of securities price formation to explain, among other things, the stock price bubble of the late 1990s. In fact, even proponents of the efficient market hypothesis have claimed that securities were mispriced during this period. If courts were to adopt behavioral finance explanations of securities market behavior, then prior precedent would not be appropriate in a number of areas of securities fraud including reliance, materiality, causation and damages. We explore the implications of how analysis of these issues would be changed by the application of behavioral finance.*

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## I. BACKGROUND ON FRAUD ON THE MARKET

Regardless of how well-accepted an economic theory is within the discipline, its application in litigation will be met initially with skepticism and the nearly insurmountable barrier of lack of precedent. This is not so with the efficient market hypothesis. It was accepted by a federal court within five years of its academic delineation. In another thirteen years it became a presumption for plaintiffs in shareholder class actions in most circuits and was so adopted by the Supreme Court in *Basic v. Levinson*.<sup>1</sup>

It might be thought that the speed of a theory's judicial acceptance is proportional to the confidence of the profession in the theory. There are, however, counter-examples to show that this correlation is not universally, and perhaps not even often, true. For instance, the notion that the injury from market power is artificially reduced output (causing higher prices) had been economic doctrine for many decades before courts used this concept to distinguish those antitrust actions that did not injure competition. Similarly, the concept that prices equal to marginal cost is the ideal has been bedrock economics since the nineteenth century but did not even have a noticeable effect on the prices regulators allowed for regulated monopolies until the 1970s. Ironically, the lack of correlation between speed of adoption and professional acceptance is shown by the efficient market hypothesis example. At the time of its endorsement by the *Basic* Court's majority, economists were beginning to find anomalies in securities prices that appeared to be inconsistent with the logical implications of the efficient market hypothesis.

What then explains the Court's plurality relying on a theory that had not yet gone through as much academic give and take as others that courts had rejected? The reason seems to lie in the need for the efficient market hypothesis to solve a procedural problem. Without the efficient market hypothesis, there appeared to be a loophole in using the class action remedy for securities fraud. As described more fully below, defendants could make a reasonable claim that individual issues of reliance would require separate trials for each plaintiff. This meant that if the securities fraud caused only hundreds of dollars in damages to the average shareholder then it was unlikely that the vast majority of shareholders would find it worthwhile to pursue a full-blown litigation; yet under these same circumstances the number of shareholders suffering a loss could be in the tens of thousands and the aggregate damages could be in the millions. To salvage the class action remedy, the Supreme Court made the reliance requirement a much

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<sup>1</sup>485 U.S. 224, 245-48 (1988).

easier burden by allowing plaintiffs to presume that securities traded in an efficient market when the market was liquid. Stated another way, the Court made a policy decision to promote the deterrence effect of private rights of action under the securities laws even as the underpinnings of the economic theory were beginning to wobble.

### A. *Barriers to Class Certification in Securities Fraud Claims*

#### 1. Requirements for a Fraud Claim under the Securities Exchange Act of 1934

Prior to the fraud-on-the-market theory, the traditional burden of proof on plaintiffs in a securities fraud action was based on the common law theory of deceit.<sup>2</sup> This required showing, among other things, the following: (1) materiality—whether the misstatement or omission was important to a reasonable investor; (2) scienter—whether defendants acted with some degree of intent; (3) reliance—whether the investor's decision to trade was affected by the omission or misstatement (also sometimes called transaction causation); and (4) loss causation—whether the misstatement or omission was the proximate cause of the loss to the investor.<sup>3</sup>

The fraud-on-the-market theory left these requirements intact, but allowed for a presumption of reliance if the security traded in an efficient market.<sup>4</sup> The reasoning behind this, as discussed more fully below, was that all investors rely on the market price when making a purchase decision, so that if the market price reflected the effects of an omission or misstatement, then every investor could be presumed to have relied on information that incorporated that omission or misstatement.<sup>5</sup> This presumption was rebuttable, meaning that if it could be shown that an investor would have made the same purchase decision even knowing of the omission or misstatement, then that investor would not be part of the class.<sup>6</sup> The fraud-on-the market theory therefore eased the burden on plaintiffs (or their counsel) from showing that each and every potential class member read the document with a misstatement or the portion of the document where the omitted material should have been included, instead allowing

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<sup>2</sup>See Barbara Black, *Fraud on the Market: A Criticism of Dispensing with Reliance Requirements in Certain Open Market Transactions*, 62 N.C. L. REV. 435, 439 (1984).

<sup>3</sup>See *Greenwald v. Integrated Energy*, 102 F.R.D. 65, 68 (S.D. Tex. 1984).

<sup>4</sup>*Basic*, 485 U.S. at 242-47.

<sup>5</sup>*Id.* at 245-47.

<sup>6</sup>*Id.*

them to make a single showing that the security traded in an efficient market.<sup>7</sup>

## 2. Requirements for a Claim under the Securities Act of 1933

The Securities Act of 1933 (the '33 Act) did not contain the requirements of scienter. Instead, it was sufficient, for example under Section 11, the most commonly used provision, to show that if a registration statement "contained an untrue statement of a material fact or omitted to state a material fact . . . any person acquiring such security (unless it is proved that at the time of such acquisition he knew of such untruth or omission) may" bring a claim.<sup>8</sup> The materiality requirement, therefore, is also present in Section 11.

The burden of loss causation, however, is shifted to defendants. There is a statutory formula for baseline damages under Section 11; these damages can be reduced

if the defendant proves that any portion of all of such damages represents other than the depreciation in value of such security resulting from such part of the registration statement, with respect to which his liability is asserted, not being true or omitting to state a material fact required to be stated therein.<sup>9</sup>

The reliance requirement, however, is more complicated. One can think of there being two types of potential plaintiffs depending on the time they buy:

1. In the offering and in the aftermarket before twelve months of post-offering financials have become public: Plaintiffs do not have to prove reliance;
2. After twelve months of post-initial public offering (IPO) earnings statements have become public: Plaintiffs have to show that they relied on the misinformation in the registration statement.

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<sup>7</sup>*Id.* at 242-49.

<sup>8</sup>Securities Act of 1933, § 11(a), 15 U.S.C. § 77k(a) (2000).

<sup>9</sup>*Id.* § 11(e), 15 U.S.C. § 77k(e).

The fraud-on-the-market presumption would only be relevant, then, for the plaintiffs who made aftermarket purchases in the time period after twelve months of financials have been filed.<sup>10</sup>

At the present time there is a conflict among courts as to whether Section 11 plaintiffs are to be accorded the fraud-on-the-market presumption of reliance. Two opinions, both decided a few years before the Supreme Court decided *Basic v. Levinson* but after most circuits had accepted fraud on the market for 10b-5 claims, found that the fraud-on-the-market presumption is not appropriate for Section 11 plaintiffs.<sup>11</sup> In one of these cases, *Greenwald*, the court implied that plaintiffs, already having a "minimal burden of proof," would have no burden at all, other than materiality, if the fraud-on-the-market presumption were to apply.<sup>12</sup> Keeping a heightened reliance requirement for plaintiffs would appear to be consistent with Congressional intent in the '33 Act.<sup>13</sup> Nonetheless, the most recent decision to address the issue finds that "[t]he reasons identified in *Basic* that drove the adoption of the presumption in the context of a Section 10(b) claim also support its application to the plaintiffs' Section 11 claim."<sup>14</sup> If this becomes the prevailing rule, then the efficient market hypothesis will have an important role in a significant number of future Section 11 claims.

### 3. The Burden of Proving Reliance While Meeting the Standards for Class Certification

The class action procedure is intended to be a more efficient means of adjudicating disputes without sacrificing individual access to justice by plaintiffs or reasonable defenses by defendants. In the context of securities litigation, class certification is a means of determining the set of plaintiffs that will be represented by named plaintiffs and the issues that will be adjudicated in a common trial for the class. The court can certify a class

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<sup>10</sup>The SEC has offered guidance on the definition of earnings statements in the context of Section 11. See Definition of Terms, Securities Act of 1933 Release No. 33-6485, 28 SEC Docket 1146 (Sept. 23, 1983). In essence, four quarters of SEC filed income statements (e.g., 10-Qs and 10-Ks) satisfy the requirement for twelve months of earnings statements.

<sup>11</sup>*In re Storage Tech. Corp. Sec. Litig.*, 113 F.R.D. 113, 121 (D. Colo. 1986); *Greenwald*, 102 F.R.D. at 71.

<sup>12</sup>*Greenwald*, 102 F.R.D. at 71.

<sup>13</sup>ARNOLD S. JACOBS, DISCLOSURE & REMEDIES UNDER THE SECURITIES LAWS § 3.38 (2003) (noting that the Congressional language is consistent with the notion that price would have impounded the information in the most recent four quarters of "earnings statement[s], whether correct or not").

<sup>14</sup>*In re WorldCom Inc. Sec. Litig.*, 219 F.R.D. 267, 294 (S.D.N.Y. 2003).

that meets the requirements of Federal Rule of Civil Procedure (FRCP) 23(a):

One or more members of a class may sue or be sued as representative parties on behalf of all only if (1) the class is so numerous that joinder of all members is impracticable, (2) there are questions of law or fact common to the class, (3) the claims or defenses of the representative parties are typical of the claims or defenses of the class, and (4) the representative parties will fairly and adequately protect the interests of the class.<sup>15</sup>

Certification of shareholder fraud cases is almost always sought under FRCP 23(b)(3), which must meet the following, additional requirement: "[T]hat the questions of law or fact common to the members of the class predominate over any questions affecting only individual members, and that a class action is superior to other available methods for the fair and efficient adjudication of the controversy."<sup>16</sup>

Proving reliance in the absence of the fraud-on-the-market hypothesis is at best a tedious proposition for plaintiffs' counsel. In the most fortuitous circumstances, plaintiffs' counsel would simply have to have each individual plaintiff certify that he or she read the document that contained the misstatement. If a court accepts a simple affidavit to that effect, giving no particulars, then this becomes a time-consuming task, though not necessarily much more difficult than the ultimate claims process. If the affidavit has to state when the plaintiffs read the document and how it fits into their investment decisions, then the task becomes more cumbersome. The use of the same language in each affidavit might be seen as an attempt to avoid an inquiry into whether each individual plaintiff actually considered the information under consideration; using separate language for each affidavit corresponding to the recollection of each plaintiff, on the other hand, would become a more burdensome undertaking.

At worst, the use of separate language for each plaintiff's affidavit raises the specter of violating the third requirement under FRCP 23(a): that the claims or defenses of the representative parties are typical of those of the class.<sup>17</sup> Suppose that in some case a named representative relied on data on historical sales while some individual plaintiffs relied on marketing studies that related to future sales. The named representative's claims now

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<sup>15</sup>FED. R. CIV. P. 23(a).

<sup>16</sup>*Id.* 23(b)(3).

<sup>17</sup>*Id.* 23(a).

relate to a different aspect of the alleged misstatements than do the individual plaintiff's claims. The solution is for the named plaintiffs as a group to have relied on each and every possible misstatement, testifying that had a single one been stated correctly, then one or more would not have made their investments. Anything less leaves open the possibility that some, and perhaps many, class members relied solely on misstatements for which the named plaintiffs are not basing their claims and with regard to which they have little incentive to protect the interests of the other class members. Moreover, unless each of the other class members also relied on each misstatement, one could argue that their damage claim is limited to the inflation caused by only those false statements that they relied upon. This reduces the size of overall damages, unless, of course, plaintiffs' counsel are lucky enough to discover that each plaintiff they approach happened to have specifically read and relied upon every single misstatement at issue in existence when they made their purchase.

*B. Invocation of the Efficient Market Hypothesis  
as a Solution to Proving Classwide Reliance*

1. The Efficient Market Hypothesis as of 1988

The efficient market hypothesis started as an academic attempt to answer a question of interest not only to economists but also to virtually all investors: is it possible to beat the stock market? Initial research on the subject focused on the stochastic nature of stock prices, finding them to follow a random walk with a drift equal to the average return. The implication of this is that an investor using only past price data to forecast the future prices of stocks, would do no better than selecting on the basis of throwing darts at a listing of actively traded stocks.<sup>18</sup> There was more than a suspicion, however, that this research did not actually answer the question because it was obvious that stock price movements were caused by events such as dividend changes, earnings announcements and so forth. Another question then, is whether an investor with access to all publicly-available information about the firm and its markets, in addition to past prices, and with sufficient analytical prowess could outperform the market.

Explorations along these lines led to the conclusion that stock market efficiency should be defined in several ways. At the time of *Basic*, there

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<sup>18</sup>For a particularly accessible review of this theory that predated the 1987 stock market crash and the Internet bubble of the late '90s, see BURTON G. MALKIEL, *A RANDOM WALK DOWN WALL STREET* (4th ed. 1985).

were three forms of the efficient market hypothesis commonly proposed.<sup>19</sup> Each form asks whether the current price of the stock incorporates accurately all past information falling into various categories. If so, then an investor cannot find a stock that is undervalued using that category of information. This, in turn, would prevent investors from earning higher than a market return by analyzing stocks with that information.

The results of research on the three forms of the efficient market hypothesis can be briefly summarized as follows:

1. *Weak Form.* This is the earliest version of the hypothesis and is tested using only data on past returns on the stock itself. This test is commonly described as determining whether technical analysis (e.g., chart patterns and moving averages) is useful for buy and sell decisions. The techniques used to analyze this form of the hypothesis include rather advanced time series analyses—tools used in econometrics and sophisticated statistical inference. This form of the hypothesis has gained widespread acceptance. That is, data on past prices do not provide an investor with enough information to earn a higher than market return when transaction costs are also taken into account.<sup>20</sup>
2. *Semi-Strong Form.* This version asks whether an analyst can use all publicly available information to do better than the market. If that were possible, fundamental analysis (using information on the firm, its markets and macroeconomic conditions) would help investors. To analyze the effects of this type of information on stock returns, the event study technique was developed. (This is described in more detail below.) Although there had been respected opposition as well as observed anomalies, this form of the

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<sup>19</sup>See RICHARD A. BREALEY, AN INTRODUCTION TO RISK AND RETURN FROM COMMON STOCKS (2d ed. 1983); EDWIN J. ELTON & MARTIN J. GRUBER, MODERN PORTFOLIO THEORY AND INVESTMENT ANALYSIS (2d ed. 1984); EUGENE F. FAMA, FOUNDATIONS OF FINANCE (1976); WILLIAM F. SHARPE, INVESTMENTS (3d ed. 1985); Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970) [hereinafter Fama, *Efficient Capital Markets*].

<sup>20</sup>Fama, *Efficient Capital Markets*, *supra* note 19, at 389-404.

hypothesis was also widely accepted at the time of *Basic*.<sup>21</sup>

3. *Strong Form*. Finally, there is the question of whether all information, public and otherwise, is incorporated into stock prices. The research on this form of the hypothesis has focused on the performance of several groups who, it is believed, may have access to more information than is publicly available: portfolio managers, investment analysts, stock exchange specialists and insiders. At the time of *Basic*, the findings from this research had been mixed. Portfolio managers and investment analysts had been shown to yield only modest (if any) higher returns than the market. Alternatively, stock exchange specialists and insiders did significantly better than the market. Primarily on the basis of the latter findings, this form of the efficient markets hypothesis was rejected.<sup>22</sup>

## 2. Academic and Judicial Acceptance

The efficient market hypothesis is the basis of the fraud-on-the-market theory that the Supreme Court established as a rebuttable presumption of liability for the majority of securities fraud cases. First introduced in law review articles in 1974,<sup>23</sup> by the time the Supreme Court ruled, the Justices could rely on a large body of academic literature exploring the potential impact of the efficient market hypothesis on securities litigation and regulation.<sup>24</sup> Also, judicial acceptance of the

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<sup>21</sup>See *id.* at 404-09.

<sup>22</sup>See *id.* at 409-13.

<sup>23</sup>Philip J. Leas, Note, *The Measure of Damages in Rule 10b-5 Cases Involving Actively Traded Securities*, 26 STAN. L. REV. 371 (1974).

<sup>24</sup>See, e.g., Jared Tobin Finkelstein, Note, *Rule 10b-5 Damage Computation: Application of Financial Theory to Determine Net Economic Loss*, 51 FORDHAM L. REV. 838, 858-68 (1983); Daniel R. Fischel, *Use of Modern Finance Theory in Securities Fraud Cases Involving Actively Traded Securities*, 38 BUS. LAW. 1 (1982). See Roger J. Dennis, *Materiality and the Efficient Capital Market Model: A Recipe for the Total Mix*, 25 WM. & MARY L. REV. 373, 376 (1984); Marvin G. Pickholz & Edward B. Horahan III, *The SEC's Version of the Efficient Market Theory and its Impact on Securities Law Liabilities*, 39 WASH. & LEE L. REV. 943 (1982); Christopher Paul Saair, Note, *The Efficient Capital Market Hypothesis, Economic Theory and the Regulation of the Securities Industry*, 29 STAN. L. REV. 1031, 1034-57 (1977); David J. Schulte, *The Fraud on the Market Theory: Efficient Markets and the Defenses to an Implied 10b-5 Action*, 70 IOWA L. REV. 975 (1985); Note, *The Fraud-on-the-Market Theory*, 95 HARV. L. REV. 1143, 1154-56

efficient market hypothesis had been nothing short of phenomenal; with an initial favorable court decision in 1975,<sup>25</sup> it became law in most circuits within ten years.<sup>26</sup>

### 3. *Basic v. Levinson* Solves the Problem of Reliance in Class Certification

The most dramatic effect of the fraud-on-the-market theory is in the area of reliance. In effect, if the securities at issue traded in an efficient market, then reliance is presumed. More particularly, the Supreme Court stated that to invoke the fraud-on-the-market theory the plaintiff should show only the following: (1) defendants made public misrepresentations, (2) the misrepresentations were material (a reasonable investor would misvalue the stock), (3) shares traded in an efficient market, and (4) plaintiff traded between the time the misrepresentations were made and the truth was revealed.<sup>27</sup> In essence, the Court accepted that securities prices *accurately* reflect all publicly available information about the *value* of a security and investors have a right to expect that publicly available information is accurate and reasonably complete. If, on the other hand, the price of the stock were to be inflated because of misstatements, then the Court presumed that the rational investor would not buy the security knowing that the price was inflated. The Court, in essence, presumed that investors rely on prices in the market as reflecting truthful statements free of material omissions.<sup>28</sup>

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(1982).

<sup>25</sup>*Blackie v. Barrack*, 524 F.2d 891 (9th Cir. 1975).

<sup>26</sup>For complete citations, see Schulte, *supra* note 24, at 977-78, and Black, *supra* note 2, at 435-37.

<sup>27</sup>See *Basic*, 485 U.S. 248 n.27. The reliance requirement had already been dispensed with in securities litigation over material omissions (as distinct from misrepresentations). See also *Affiliated Ute Citizens v. United States*, 406 U.S. 128, 153-55 (1972) (stating that "positive proof of reliance is not a prerequisite to recovery").

<sup>28</sup>As noted by Justice Blackmun in the decision for the plurality, this would appear to be fully consistent with the public policy that Congress intended in the Securities Exchange Act of 1934 (the '34 Act). *Basic*, 485 U.S. at 245-46. Unlike other markets, where *caveat emptor* is the rule, Congress felt that securities markets required full information be equally available to all investors. See Fischel, *supra* note 24, at 2-3. The SEC still uses disclosure as its primary regulatory tool. See Stephen J. Choi & A.C. Pritchard, *Behavioral Economics and the SEC*, 56 STAN. L. REV. 1, 21-23 (2003). Note, however, that Justice White's dissent in *Basic* takes his colleagues to task for ignoring Congressional intent:

Congress thus anticipated meaningful proof of "reliance" before civil recovery can be had under the Securities Exchange Act. The majority's adoption of the fraud-on-the-market theory effectively eviscerates the reliance rule in actions brought under Rule 10b-5, and negates congressional intent to the contrary

This, in turn, made class certification an easier matter. As long as individual investors do not have to make separate showings of reliance, common issues of proof for all traders over the period of the fraud predominate.

## II. THE IMPACT OF THE EFFICIENT MARKET HYPOTHESIS ON SHAREHOLDER CLASS ACTION LITIGATION

### A. *Class Certification*

There have been few cases where class certification has been denied because of the lack of an efficient market. In part, this comes from the interaction between the parties and the court. Given the large number of potential opportunities available, the plaintiffs' bar does not have a great incentive to go after cases where market efficiency is in serious question. Moreover, because companies that are likely to trade in an inefficient market are almost always significantly smaller than average and have lower volume, the potential damages are also likely to be smaller, another reason why these cases are not as promising for plaintiffs' counsel as are others.

If market efficiency becomes a serious issue, then plaintiffs' counsel may decide to settle rather than wait to see how the court rules. Next, some courts have adopted a position of deferring the actual decision about market efficiency until later in the case, deciding that plaintiffs must only allege, but not prove, that the stock traded in an efficient market.<sup>29</sup>

Cases where a court has found that a stock was not proven to trade in an efficient market include *Serfaty v. International Automated Systems, Inc.*<sup>30</sup> and *Krogman v. Sterritt*,<sup>31</sup> finding various indicia of market efficiency such as a high trading volume or a large float were absent. In *Binder v. Gillespie*, the court decertified a class on summary judgment finding that the securities at issue were illiquid and were not traded on an efficient market.<sup>32</sup>

There have been a small number of cases where a court has found that the presumption of reliance under fraud-on-the-market does not apply to all investors in the class. In *Ganesh L.L.C. v. Computer Learning*

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expressed during adoption of the 1934 Act.  
*Basic*, 485 U.S. at 258.

<sup>29</sup>See, for example, *Hayes v. Gross*, 982 F.2d 104, 107 (3d Cir. 1992) ("[The] question on a motion to dismiss is not whether plaintiff has proved an efficient market, but whether he has pleaded one.").

<sup>30</sup>180 F.R.D. 418, 423 (D. Utah 1998).

<sup>31</sup>202 F.R.D. 467, 479 (N.D. Tex. 2001).

<sup>32</sup>184 F.3d 1059, 1064-65 (9th Cir. 1999).

*Centers, Inc.*<sup>33</sup> and in *In re Polymedica Corp. Securities Litigation*,<sup>34</sup> the courts excluded from the class short sellers, i.e., investors that held a short position in the stock. The court held that "[s]hort sellers may not rely on the 'fraud on the market' presumption of reliance" since these investors "sell short because they believe that the market price is somehow mistaken."<sup>35</sup>

B. *Usefulness of Event Studies and the Efficient Market Hypothesis for Evidence on Liability and Damages*

1. Materiality

While there have been various definitions of materiality in the case law, they all tend to relate back to the question of whether the decision by a reasonable investor to trade at a particular price would have been affected by knowing the omitted or misstated information.<sup>36</sup> The *Basic* opinion notes this connection somewhat obliquely when it discusses how reliance can be disproved:

The [circuit] court acknowledged that petitioners may . . . show that the misrepresentation in fact did not lead to a distortion of price . . . .

Any showing that severs the link between the alleged misrepresentation and either the price received (or paid) by the plaintiff, or his decision to trade at a fair market price, will be sufficient to rebut the presumption of reliance. For example, if petitioners could show that the "market makers" were privy to the truth about the merger discussions here with Combustion, and thus that the market price would not have been affected by their misrepresentations, the causal connection could be broken: the basis for finding that the fraud had been transmitted through market price would be gone. Similarly, if, despite petitioners' allegedly fraudulent attempt to manipulate market price, news of the merger discussions credibly entered the market and dissipated the effects of the misstatements, those who traded *Basic* shares

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<sup>33</sup>183 F.R.D. 487, 491 (E.D. Va. 1998).

<sup>34</sup>224 F.R.D. 27, 44 (D. Mass. 2004).

<sup>35</sup>*Id.*

<sup>36</sup>This generalization obviously excludes the line of securities cases dealing with proxy contests. Rather, it applies to causes of action "in connection with" trading activity.

after the corrective statements would have no direct or indirect connection with the fraud.<sup>37</sup>

Sometimes this is phrased as whether that information altered the total mix of information available to investors in such a way as to affect their investment decisions.<sup>38</sup>

From this starting point, one can ask the economic question of how a change in investors' decisions to trade at a given price could be observed. The straightforward answer is that if the information would cause more investors to want to buy at a particular price, the previous supply-and-demand equilibrium would be upset and the price would have to rise until the demand for the stock once again equaled its supply. This, of course, says that materially positive news causes a stock's price to rise. If the information is not material, then investors' decisions to buy or not are unaffected, and the previous supply-and-demand equilibrium will still hold. Therefore, there is an economic equivalence between information material to investors' decisions to buy and sell and the price of a security.

From this, it follows that changes in material information should cause material changes in the price of a security. To an economist, a change in the price of a security is measured through means of an event study. An event study is a statistical analysis that isolates the effects of an event on a security's price and measures the likelihood that the effect could have been due to the normal random fluctuations of the security's price as opposed to being due to a particular event.<sup>39</sup> There is extensive literature on the proper procedures for event studies,<sup>40</sup> and numerous courts have determined that in shareholder class actions, an event study or some similar statistical procedure is necessary to determine whether a price movement is material and, if so, to quantify the portion of the price movement due to the event under consideration.<sup>41</sup>

Thus, there is a natural relationship between the legal terminology of material information and the economic analyses of statistically

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<sup>37</sup>*Basic*, 485 U.S. at 248-49 (footnote omitted).

<sup>38</sup>*TSC Indus., Inc. v. Northway, Inc.*, 426 U.S. 438, 449 (1976).

<sup>39</sup>See A. Craig MacKinlay, *Event Studies in Economics and Finance*, 35 J. ECON. LIT. 13, 13 (1997).

<sup>40</sup>*Id.* See, e.g., David I. Tabak & Frederick C. Dunbar, *Materiality and Magnitude: Event Studies in the Courtroom* (NERA Working Paper No. 34, 1999), reprinted in LITIGATION SERVICES HANDBOOK: THE ROLE OF THE FINANCIAL EXPERT (Roman L. Weil et al. eds., 3d ed. 2001).

<sup>41</sup>See, e.g., *In re Executive Telecard, Ltd. Sec. Litig.*, 979 F. Supp. 1021, 1024-26 (S.D.N.Y.1997); *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F. Supp. 2d 1005, 1014-15 (C.D. Cal. 2003).

significant price movements. Material information is that information that causes a stock price to move in a way that was not likely due to chance. In an efficient market, the tools of economics and econometrics are therefore useful in answering the question about whether certain information was material. In fact, in cases where there is a known disclosure of relevant information, courts have often found event studies dispositive in determining that the information either was or was not material.<sup>42</sup>

## 2. Transaction Causation

Looking again at the definition of material information, we see that it is information that would cause a reasonable investor to change her investment decision. Within the context of shareholder class actions, this becomes the question of whether the investor would still have engaged in the transaction at the given price had she known the truth about the omitted or misstated information. As noted above, the *Basic* decision established that in an efficient market, one could presume that traders relied upon the market price to reflect all public information.<sup>43</sup> As the Court said, "It has been noted that 'it is hard to imagine that there ever is a buyer or seller who does not rely on market integrity. Who would knowingly roll the dice in a crooked crap game?'"<sup>44</sup>

Because material information is defined as information that would affect the transaction decision, if that information is impounded in a stock price, then the stock price itself provides the evidence as to whether the information would generally affect transaction decisions. As has been noted by various courts, under the efficient market theory, materiality and transaction causation often blend together: if a stock price is statistically different from where it would be in the absence of fraud, then the relevant information was both material to the price and can be presumed to have caused the transactions at that price.<sup>45</sup> Thus, the same event study tools that are used to examine materiality will simultaneously help decide the question of transaction causation.

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<sup>42</sup>As examples, see *In re Seagate Tech. II Sec. Litig.*, 843 F. Supp. 1341, 1368 (N.D. Cal. 1994); *Goldkrantz v. Griffin*, No. 97 Civ. 9075(DLC), 1999 WL 191540, at \*4-5 (S.D.N.Y. Apr. 6, 1999).

<sup>43</sup>See *supra* notes 27-28 and accompanying text.

<sup>44</sup>*Basic*, 485 U.S. at 246-47 (quoting *Schlanger v. Four-Phase Sys., Inc.*, 555 F. Supp. 535, 538 (S.D.N.Y. 1982)).

<sup>45</sup>The presumption of reliance, and hence transaction causation, is rebuttable, however. As will be discussed later in this article, certain investors may still trade at an "incorrect" price even if they know the price is incorrect.

### 3. Loss Causation

To establish damages in a securities fraud claim, the Private Securities Litigation Reform Act (PSLRA) states, "In any private action arising under this chapter, the plaintiff shall have the burden of proving that the act or omission of the defendant alleged to violate this chapter caused *the loss for which the plaintiff seeks to recover damages.*"<sup>46</sup> Thus, plaintiffs are required to show that the decline in price—that is, the loss as plaintiffs' holdings went down in value—was due to defendants' actions.<sup>47</sup>

Once again, an event study provides a proper answer to this question, as it is specifically designed to measure the impact of a news event on a security's price. This means that the concepts of materiality, loss causation, and transaction causation are often all answered, at least on a preliminary basis, by employing an event study to examine whether the relevant information caused a statistically significant change in the price of the security.

### 4. Damages

Finally, event studies have also proven to be the principal basis for many, if not most, damage analyses. In the simplest kind of shareholder class action, there is a single disclosure at the end of the class period that causes a significant decline in the stock price. An event study is then used to measure the magnitude of the drop caused by the news disclosure by accounting for market and industry effects and the effects of any other

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<sup>46</sup>15 U.S.C. § 78u-4(b)(4) (2000) (emphasis added). For a discussion, see Jeffrey L. Oldham, *Taking "Efficient Markets" Out of the Fraud-on-the-Market Doctrine After the Private Securities Litigation Reform Act*, 97 NW. U. L. REV. 995 (2003). Mr. Oldham argues that:

[i]n conclusion, the PSLRA substantially undermines the fraud-on-the-market presumption as interpreted and applied by courts. First, the PSLRA mandates that plaintiffs prove loss causation and therefore vitiates the use of the [efficient market hypothesis ("EMH")] in the fraud-on-the-market doctrine, since use of the EMH necessarily shifts the burden of disproving loss causation onto defendants at the class certification stage and thereby permits the advance of lawsuits without any showing that the defendants are responsible for the plaintiffs' loss . . . . Thus, although the PSLRA does not spell doom for the existence of the fraud-on-the-market doctrine and its underlying theory of indirect reliance, it is inconsistent with the form of the doctrine that presumes the loss-causation trigger based on the EMH.

*Id.* at 1030.

<sup>47</sup>While there was previously a split on this issue, the Supreme Court, on April 19, 2005, resolved the dispute in *Dura Pharmaceuticals, Inc. v. Broudo*, 125 S. Ct. 1627 (2005). It affirmed the position taken by the majority of the circuits whereby plaintiffs have to prove that their loss is tied to a price decline that is due to the fraud or its disclosure. *Id.* at 1633-34.

company-specific news on that date. The resultant figure is the amount of inflation immediately preceding the corrective disclosure. This amount is then typically assumed to be constant throughout the class period, thereby providing the measure of inflation on each day.<sup>48</sup>

### III. THE BEHAVIORAL FINANCE CHALLENGE TO THE EFFICIENT MARKET HYPOTHESIS

The efficient market hypothesis has been so well accepted that it is not disputed in the vast majority of shareholder class actions. For the most part, a defense strategy of avoiding a challenge to the efficient market hypothesis is prudent; defendant corporations' shares are usually actively traded, followed by analysts and owned by large, sophisticated buyers. Moreover, after *Basic*, until the Internet bubble, there was no reason to believe that the market as a whole was behaving oddly. Circumstances were different, however, during the explosive growth phase in technology stock prices in the late 1990s. A number of commentators indicated that there appeared to be mispricing, though many also said that it was limited in time to the bubble. Nonetheless, even temporary mispricing rebuts the fraud-on-the-market presumption for some class members in a shareholder lawsuit.

At the same time, a new academic field, known as behavioral finance, was gaining momentum. Economists, building on studies in psychology, documented aspects of "irrationality" in investors' behavior and explored the implications of these deviations from rationality on financial markets. In particular, models that incorporated these alternative assumptions on investors' behavior explained many of the anomalies empirically documented in financial markets. The growing academic literature documenting violations of the efficient market hypothesis, along with the accumulated research on "irrationality" of some investors, should prompt scholars, practitioners and regulators to examine the implications of these developments on securities law in general, and on the unchallenged applicability of fraud-on-the-market theory in particular.<sup>49</sup>

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<sup>48</sup>In some cases, the percentage of the inflation may be assumed to be constant or a more complicated relationship may exist between the measured inflation at the end of the class period and the inflation at other points. To the extent that damages are limited to the loss caused by the drop, any damage analyses based on such measures should be capped so that no plaintiff receives a claim larger than the actual drop caused by the disclosure of the previously omitted or misstated information.

<sup>49</sup>For related discussions on the implications of these advances in behavioral finance, see Donald C. Langevroot, "*Taming the Animal Spirits of the Stock Markets: A Behavioral Approach to Securities Regulation*," 97 NW. U. REV. 135 (2002); Lynn A. Stout, "*The Mechanisms of*

### A. Revisiting Definitions

One of the themes in academic debate since *Basic* is a refinement of how efficiency should be defined in the context of securities markets. This goes beyond the three forms of the efficient market hypothesis described above (weak, semi-strong, and strong) to the issue of what is meant by the price reflecting publicly available information.

#### 1. Informational Efficiency: Investors Cannot Make Excess Returns Even If They Are Aware of All Publicly Available Information

Informational efficiency tends to be driven by the concept that if the market was not efficient then some group of investors, often referred to as arbitrageurs, armed only with publicly available information would be able to outperform the market persistently.<sup>50</sup> A recent exchange of views about stock market efficiency in *The Journal of Economic Perspectives* kept this distinction. Burton Malkiel described its conclusion as follows: "[P]rices fully reflect all known information, and even uninformed investors buying a diversified portfolio at the tableau of prices given by the market will obtain a rate of return as generous as that achieved by experts."<sup>51</sup>

One reason that the two concepts were often not distinguished is that one seems to imply the other. This is the opinion of another efficient market advocate, Richard Roll, as expressed in an earlier academic debate: "[A] true market *inefficiency* ought to be an exploitable opportunity. If there's nothing investors can exploit in a systematic way, time in and time out, then it's very hard to say that information is not being properly incorporated into stock prices."<sup>52</sup>

In this view, if news is not properly incorporated into a stock price, then the price is either higher or lower than the present value of the future cash flows. If the price is too low, in theory, an investor should on average make money by buying that stock and pocketing the future cash flows. While there would be some risk involved in buying one stock, investors

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*Market Inefficiency: An Introduction to the New Finance*, 28 J. CORP. L. 635 (2003).

<sup>50</sup>Barberis and Thaler label this condition of no arbitrage profits as "no free lunch," borrowing the expression from Milton Friedman's famous book. MILTON FRIEDMAN, *THERE'S NO SUCH THING AS A FREE LUNCH* (Open Court Publishing Co. 1975). See Nicholas Barberis & Richard Thaler, *A Survey of Behavioral Finance*, in *HANDBOOK OF THE ECONOMICS OF FINANCE* 1054, 1056 (George M. Constantinides et al. eds. 2003).

<sup>51</sup>Burton G. Malkiel, *The Efficient Market Hypothesis and Its Critics*, 17 J. ECON. PERSP. 1, 59 (2003).

<sup>52</sup>Richard Roll & Robert J. Shiller, *Comments: Symposium on Volatility in U.S. and Japanese Stock Markets*, 5 J. APPLIED CORP. FIN. 25, 31 (1992).

purchasing a large sample of underpriced stocks would be able to beat the market with near certainty. Of course, an investor may not be around to collect all of the cash flows over the life of the corporation. The counter-argument to this is that as long as the corporation has a finite life, one can work backwards from the (uncertain) end of the corporation's life, showing that trades right before the end must be properly priced, as must the trades shortly before then, and so forth until the present. A similar argument would hold for overpriced securities: an investor should be able to short the security and use the proceeds to pay the future cash flows she would owe and still have money left over.

The importance of whether excess returns can be earned is crucial in much of the empirical research on the efficient market hypothesis. Multiple tests of whether various investment strategies or various types of market professionals could outperform risk-adjusted returns based on throwing darts at a list of stocks have shown the following: (1) stock market professionals do not outperform broad market indices;<sup>53</sup> (2) many observed anomalies in the market (e.g., larger returns in January, larger returns from small-cap stocks, larger returns from value investing) tend to be temporary or otherwise explained by properly taking account of the risk factors and/or transactions costs of the strategy.<sup>54</sup>

## 2. Fundamental Efficiency: Stock Prices Impound Publicly Available Information Correctly

The definition of efficient markets that is often rebutted by proponents of behavioral finance tends to be based on a concept that the share price is an accurate estimate of fundamental value. A market is said to be fundamentally efficient if it correctly impounds all publicly available information so that the price of the security matches an objective measure of value.<sup>55</sup> All would agree that the value of a stock is equal to the expected discounted present value of future dividends to be distributed to that share.<sup>56</sup> Recently, a paper coauthored by a leading behavioral

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<sup>53</sup>See Mark Rubinstein, *Rational Markets: Yes or No? The Affirmative Case*, 57 FIN. ANALYSTS J. 15 (May-June 2001).

<sup>54</sup>*Id.* at 23-26.

<sup>55</sup>See Ronald J. Gilson & Reinier Kraakman, *The Mechanisms of Market Efficiency Twenty Years Later: The Hindsight Bias* (Columbia Law and Economic Working Paper No. 240, 2003), and (Stanford Law and Economics Olin Working Paper No. 270, 2003).

<sup>56</sup>RICHARD A. BREALEY ET AL., FUNDAMENTALS OF CORPORATE FINANCE ch. 4 (2d ed. 1995). See also Robert J. Shiller, *From Efficient Markets Theory to Behavioral Finance*, 17 J. ECON. PERSP. 83, 84-85 (2003).

The efficient markets model can be stated as asserting that the price  $P_t$  of a share

economist, Richard Thaler, made the following distinction without dwelling on its implications:

The rational efficient markets hypothesis makes two classes of predictions about stock price behavior. The first is that stock prices are "correct" in the sense that asset prices reflect the true or rational value of the security. . . .

The second principle . . . is "unpredictability". In an efficient market it is not possible to predict future stock price movements based on publicly available information.<sup>57</sup>

Under this definition, the efficient market hypothesis can be rejected if there are observed prices (or price behavior) that are inconsistent with the fundamental value of the stock. Behavioral finance finds that there are occasions when informational efficiency may be present but fundamental efficiency can be rejected.

### B. *Theoretical Foundations of Efficient Markets*

In a standard asset pricing model, all agents are rational and fully informed about prices. As a result, equilibrium prices must reflect the true risk-adjusted value. Otherwise, it must be that some investors are holding inferior portfolios, and this behavior cannot be optimal for them. The efficient market hypothesis is less demanding because it argues that mispricing cannot persist even when some agents are either irrational or uninformed. The underlying propositions are:

- 1) *Arbitrage*. In well-developed securities markets, if there is a stock price anomaly, then knowledgeable rational investors will be able to acquire a securities portfolio that provides them with a risk-free excess return. For example, if a firm's shares are overpriced relative to the market, arbitrageurs can short the stock

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. . . equals the mathematical expectation, conditional on all information available at the time, of the present value  $P^*$ , of actual subsequent dividends accruing to that share. . . .  $P^*$ , is not known at time  $t$  and has to be forecasted. Efficient markets say that price equals the optimal forecast of it.

*Id.*

<sup>57</sup>Sendhil Mullainathan & Richard H. Thaler, *Behavioral Economics in INTERNATIONAL ENCYCLOPEDIA OF SOCIAL SCIENCES* 1096-97 (Neil J. Smelser & Paul B. Baltes eds., 2001).

and use the money received to buy a basket of stocks representing the market.<sup>58</sup>

- 2) *Demise of Uninformed and/or Irrational Traders.* The presence of an arbitrage opportunity implies that at least some investors are mistaken in a way that affects the aggregate demand and supply for the mispriced stock. These traders will not, however, be able to survive in the long run because they will lose money to the arbitrageurs who exploit mispricing, and so they will be forced to exit the market. For example, in the case of an overpriced security, the selling pressure of arbitrageurs combined with information processing that reveals the true value of the firm's shares will cause the price to converge to the true value, yielding gains to the arbitrageurs and losses to the uninformed investors who own shares. Consequently, not only are price anomalies transitory but the supply of uninformed traders is held in check by these traders' diminishing wealth.<sup>59</sup>
- 3) *[White] Noise Traders.* An alternative assumption, made in early models of price formation, is that the mistakes of irrational and uninformed investors were random and uncorrelated (hence the term white noise). As a result, they are likely to cancel in the aggregate, having no effect on the expected value of the stock prices (although they could affect the volatility of stock prices).<sup>60</sup>

Some critics of the efficient market hypothesis believe that it is plausible that all three of the above assumptions are wrong.<sup>61</sup> Like the efficient market hypothesis itself, each of these assumptions leads to testable hypotheses about market structure and investor behavior. The academic literature offers a range of empirically documented phenomena

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<sup>58</sup>ANDREI SHLEIFER, *INEFFICIENT MARKETS: AN INTRODUCTION TO BEHAVIORAL FINANCE* 2-5 (2000).

<sup>59</sup>*See id.*

<sup>60</sup>*See id.*

<sup>61</sup>*Id.* at 10-16.

of pricing anomalies and irrational individual behavior.<sup>62</sup> We will not attempt to review the literature, in part because some of the results are sufficiently controversial so as not to provide enough proof to rebut the fraud-on-the-market presumption. Rather we focus on a few phenomena that pose puzzles that the efficient markets proponents have not explained satisfactorily.

### C. *Limits to Arbitrage*

In this section we present situations in which there is strong evidence against market efficiency, at least in certain, nontrivial circumstances. We then discuss the two main obstacles that rational arbitrageurs may face in their attempt to correct mispricing—short sale constraints and arbitrage risk.

#### 1. Failure of Arbitrage to Enforce Securities Prices to Fully Impound All Available Information

Both proponents and opponents of the efficient market hypothesis note the difficulty in testing the hypothesis. Eugene Fama refers to this difficulty as the "joint hypothesis."<sup>63</sup> That is, any test of prices in the market inevitably requires an underlying theory describing what the true value of the securities should be.

There are some historical situations, however, that allow an opportunity for a powerful test of the efficient market hypothesis. The tests described below are based on the obvious implication that if a security's price equals fundamental value then that security cannot be traded contemporaneously at two different prices; if one price reflects fundamental value then the other cannot be equal to fundamental value.

Moreover, if a security is trading publicly at two different prices—as can happen when the option market implies a different price for the underlying security—then this information is in the market; but, it is obvious that these securities violate a requirement of informational efficiency, namely, that a security price fully reflect all available information.

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<sup>62</sup>Recent surveys on behavioral finance include Barberis & Thaler, *supra* note 50, and David Hirshleifer, *Investor Psychology and Asset Pricing*, 56 J. FIN. 1533 (2001).

<sup>63</sup>See Eugene F. Fama, *Efficient Capital Markets: II*, 46 J. FIN. 1575, 1575-76 (1991).

a. *Transparent Overpricing in Internet Carve-outs*

Lamont and Thaler focus on Internet carve-outs during the time of the technology bubble.<sup>64</sup> Their article demonstrates a violation of the law of one price on a number of occasions. An illustrative example is the case of 3Com and Palm.

In March 2000, 3Com sold 5% of its owned subsidiary Palm Inc. in an IPO, retaining ownership of the remaining 95%.<sup>65</sup> 3Com announced, and filed accordingly with the IRS, its intention to spin-off Palm completely by the end of the year.<sup>66</sup> Each shareholder of 3Com was entitled to 1.5 shares of Palm Inc. at the time of the spin off.<sup>67</sup> Therefore, each share of 3Com implied an indirect ownership of 1.5 shares of Palm.<sup>68</sup> In the aftermarket, Palm shares traded at \$95. This implied a lower bound equal to \$145 on the value of 3Com.<sup>69</sup> 3Com's price, however, was \$81, implying a negative value of—\$63 per share of 3Com's business and assets outside Palm, for a total implied capitalization of—\$22 billion.<sup>70</sup>

Because the price of a security cannot go below zero, this was an opportunity for profits by buying 3Com shares. Moreover, because Palm's shares are a perfect substitute to indirect ownership through 3Com's shares, and the prices of the two securities are certain to converge at the time of the spin off, shorting Palm eliminates any long-term systematic risk. However, a careful investigation of the opportunities to sell short reveals that it was either impossible to borrow Palm shares at all or doing so involved high transaction costs.

Another way to short Palm was through exchange-traded options. A synthetic short position in Palm was available by buying a put with the proceeds from writing a call and borrowed dollars. In an efficient market, the return on the synthetic short portfolio should equal the return to an actual short position. Lamont and Thaler found, however, that the price of a synthetic short was 29% below the price of Palm, thereby creating the real risk that even if Palm was overpriced the synthetic short arbitrage would lose money.<sup>71</sup> Alternatively stated, to reconcile the two prices for a

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<sup>64</sup>Owen A. Lamont & Richard H. Thaler, *Can the Market Add and Subtract? Mispricing in Tech Stock Carve-Outs*, 111 J. POL. ECON. 227 (2003).

<sup>65</sup>*Id.* at 230.

<sup>66</sup>*Id.*

<sup>67</sup>*Id.*

<sup>68</sup>Lamont & Thaler, *supra* note 64, at 230.

<sup>69</sup>*Id.*

<sup>70</sup>*Id.*

<sup>71</sup>*Id.* at 256.

short position, i.e., to make an investor indifferent between holding an actual short and a synthetic short, the implied annual holding costs must be 147%.<sup>72</sup> Thus the options prices suggest that shorting Palm must have been either impossible or extremely expensive. Note that in order to take advantage of the difference between the market price of Palm and the implied price from the options market, one has to short an actual share of Palm and acquire a synthetic long position. This, however, is exactly where there was a friction in the market. Therefore, while the price of at least one of the securities was not fully reflecting all available information in the market, there were no real arbitrage opportunities.

If this were the only observation of arbitrage impossibility, it might just be viewed as an interesting anomaly. Such was not the case, however. Lamont and Thaler found six equity carve-outs where the value of the parent company less the market value of the shares in the carve-out was negative.<sup>73</sup> All of these examples were technology firms traded on NASDAQ and the mispricing occurred from 1998 through 2000.<sup>74</sup> Moreover, two of the firms had exchange-traded options and, again, the value of a synthetic short was much less than the price of the security.<sup>75</sup> As observed by Lamont and Thaler: "We think a sensible reading of our evidence should cast doubt on the claim that market prices reflect rational valuations because the cases we have studied should be ones that are particularly easy for the market to get right."<sup>76</sup>

Note that shorting costs explain why a rational arbitrageur failed to take advantage of an arbitrage play, but not why anyone bought the carve-out shares. Investors in these shares were willing to hold overpriced securities and "[t]o explain that, one needs investors who are (in our specific case) irrational, woefully uninformed, endowed with strange preferences, or for some other reason are willing to hold overpriced assets."<sup>77</sup>

b. *Mispriced Twin Stocks: Royal Dutch and Shell Transport*

One might argue that the Internet carve-out example is a case where the mispricing is transitory because most carve-outs are spun off within a year. Another violation of the law of one price, however, is the mispricing

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<sup>72</sup>Lamont & Thaler, *supra* note 64, at 256.

<sup>73</sup>*Id.* at 234-35.

<sup>74</sup>*Id.*

<sup>75</sup>*Id.*

<sup>76</sup>Lamont & Thaler, *supra* note 64, at 265.

<sup>77</sup>*Id.* at 231.

over a number of years of separate tradable shares that are backed by the same operating assets. Froot and Dabora studied "Siamese-twin" company stocks and illustrated the risk that may be involved in offsetting a mispricing.<sup>78</sup> They looked at pairs of companies with charters that fix the division of current and future equity cash flows to each twin, while each company retains its own stock.<sup>79</sup> Royal Dutch, traded in the United States and in the Netherlands, and Shell Transport, traded primarily in the United Kingdom, are an example of such pair.<sup>80</sup> The chartered division, 60% for Royal Dutch and 40% for Shell Transport, implies a fixed price ratio for the two stocks.<sup>81</sup> Obviously, the capitalization of Royal Dutch should be a constant 150% of the capitalization of Shell Transport. In fact, Royal Dutch was priced anywhere from 35% below this benchmark to 15% above.<sup>82</sup> The ratio fluctuated significantly over decades and it was highly correlated with stock-market indexes in the country where the stock was traded most actively.<sup>83</sup> Also, the apparent arbitrage opportunity of one stock being overvalued relative to the other would last for years.

In theory, arbitrageurs can short the stock of the company that is currently overpriced while taking a long position in the twin company. By doing this they eliminate any fundamental risk since the companies are in fact claimants to the same pool. The ratio, however, deviates from the theoretical benchmark for extended periods. These fluctuations, associated with correlated noise traders, imply that an arbitrageur who is trying to take advantage of the mispricing may need to hold a position for an extended period of time before being able to close it at a profit.

In summary, these anomalies cast doubt on the presumption that arbitrage ensures that prices fully incorporate all available information or that they are kept at fundamental value.<sup>84</sup> There are a number of reasons why arbitrage cannot be relied upon to perform this task. In the analysis of

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<sup>78</sup>Kenneth Froot & Emile Dabora, *How Are Stock Prices Affected by the Location of Trade?* 53 J. FIN. ECON. 189 (1999).

<sup>79</sup>*Id.* at 190.

<sup>80</sup>*Id.* at 192.

<sup>81</sup>*Id.*

<sup>82</sup>Froot & Dabora, *supra* note 78, at 201.

<sup>83</sup>*Id.* at 214.

<sup>84</sup>Another anomaly that is inconsistent with the law of one price concerns closed end mutual funds. See SHLEIFER, *supra* note 58, at 53 ("[C]losed end fund shares typically sell at prices not equal to the per share market value of the assets the fund holds. Although funds sometimes sell at premia to their net asset values, in recent years discounts of 10 to 20 percent have been the norm."). Arbitrage does not bring fund prices in line with their underlying value because an infinite holding period is required and the arbitrageur's position could be liquidated at a loss. Empirical evidence shows that the patterns of mispricing among funds is consistent with (noise) traders investing on the basis of sentiment.

the 3Com/Palm carve-out these reasons included very high rebates to lenders of Palm shares, that could change over time, and the costs of search and a rebate to the lender of the Palm shares. Financial economists have long known that short sale constraints have been a weakness in the efficient market hypothesis.<sup>85</sup>

## 2. Short Sale Constraints

The ability for rational arbitrageurs to offset overpricing would usually require that they have the ability to short the stock at low transactions costs. To short a stock, an arbitrageur must borrow the stock from somebody who owns it. The lender charges the borrower a lending fee.

This leads to the first potential infirmity in the arbitrage argument: stocks that cannot be borrowed and stocks with sufficiently high lending fees lack the conditions for efficiency. Edward Miller showed that short sale constraints prevent less optimistic opinions (possibly based on negative information) from being incorporated into stock prices.<sup>86</sup> When a divergence of opinions exists in the market, for whatever reasons, the less optimistic investors are constrained in their ability to take a short position, and so they elect to stay out of the market for the stock. As a result, the marginal investor will be an optimist and the price of the stock will reflect this bias.

It has been shown that arbitrage could not remove glaring disparities in stock pricing. In some cases, stocks are often unavailable for borrowing at any price, in other cases shorting is possible but extremely costly. Ofek and Richardson argue that the market had limited ability to short Internet stocks during the Internet bubble of the late nineties.<sup>87</sup> Specifically, they present evidence of higher borrowing costs for shorting Internet firms and greater violations of put-call parity for Internet firms in the options market.<sup>88</sup> Gene D'Avolio finds that while most stocks are easy and relatively inexpensive to borrow, somewhat less than 1% of the stocks

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<sup>85</sup>Edward M. Miller, *Risk, Uncertainty, and Divergence of Opinion*, 32 J. FIN. 1151, 1162 (1977).

<sup>86</sup>*Id.* at 1160.

<sup>87</sup>Eli Ofek & Matthew Richardson, *DotCom Mania: The Rise and Fall of Internet Stock Prices*, 58 J. FIN. 1113, 1114 (2003).

<sup>88</sup>*See id.* at 1118-20. The mean and median rebate rate for Internet stocks during the bubble is respectively 1.08% and 1.45% less than the rate for other stocks. *Id.* at 1119. The differences are statistically significant. Moreover, the mean rebate rate on Internet stocks would represent the eighth percentile of the non-Internet distribution. *Id.* at 1120.

become extremely "special" and demand negative rebate rates, i.e., loan fees in excess of the risk-free rate, ranging between 10% and 79%.<sup>89</sup>

### 3. Arbitrage Risk Forecloses Rational Pricing

Rational arbitrageurs should not only be ready to take short positions in an overpriced market but should be as aggressive as it takes to correct the mispricing. There is, however, considerable risk involved with trying to offset the mispricing. First, there is a risk that the beliefs supporting the current mispricing will persist in the intermediate run, leading to yet a further increase in the price. If the arbitrageur is required to close a position too early—before the irrational/uninformed/noise traders are pushed out of the market—then the strategy will backfire.

Different reasons may require the arbitrageur to close a short position. For example, the lender of a security is entitled to ask for the borrowed securities at any time. The arbitrageur, having only a few days to do so by law, might be forced to acquire the securities at the prevailing market price, which may well be above the already overpriced purchase price. Alternatively, the arbitrageur may be a professional portfolio manager, in which case, the (possibly temporary) negative returns of the short position may cause investors to withdraw their funds.<sup>90</sup> Foreseeing this possibility may be sufficient to deter the manager from taking the short position in the first place, therefore allowing the mispricing to persist.

To illustrate the point consider Amazon.com, Inc. In mid 1998, Amazon's stock price was in the low 20s, roughly ten times its price in May 1997 shortly after its IPO. Many economists thought at that point that the stock was overpriced. Amazon was experiencing growing competition from the big brick-and-mortar book retailers going online selling books and CDs. It was selling its books at below marginal cost and was not expected to show profits (or operating profits) for a number of years. It was also facing growing competition from small new aggressive Internet retailers.<sup>91</sup> An investor who would have taken a short position on Amazon's stock then, would have had to watch Amazon's stock price increase five-fold to above \$100 in April 1999, and again in December 1999. It would not be before December 2000 that Amazon would be trading in the low 20s again. Any

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<sup>89</sup>Gene D'Avolio, *The Market for Borrowing Stock*, 66 J. FIN. ECON. 271, 273, 287 tbl. 4 (2002).

<sup>90</sup>Andrei Shleifer & Robert W. Vishny, *The Limits of Arbitrage*, 52 J. FIN. 35, 36-37 (1997).

<sup>91</sup>For example, e-tailer Buy.com, that went public in February 2000, used targeted price cuts in an attempt to win business from Amazon.

liquidation of the position before the end of about a thirty-month holding period would have been at a loss, and if the position had been within eighteen months, it would have been at a substantial loss. An investor may need to close his position for any number of reasons. Not the least is the requirement to post additional margin when the price of an overpriced stock rises, possibly creating liquidity problems for the investor or a loss if the lender recalls the loan of shares.<sup>92</sup> As the story of Amazon illustrates, if an investor is required to close his short position for some reason, the loss can be high. In fact, it is theoretically unlimited. This stands in contrast to the potential loss when an investor acquires a long position in a stock. Limited liability for all publicly traded stocks implies it is no greater than the original investment.

It is often argued that institutional investors can be relied upon as playing the role of rational arbitrageurs in the market because, among other reasons, resources are available to withstand large paper losses on the short leg of an arbitrage. Almazan et al., however, find that only about 30% of mutual funds are allowed to sell short, and only 2% actually do sell short.<sup>93</sup> As supporting evidence to the importance of institutional investors in correcting mispricing, Ofek and Richardson find that the level of institutional holding in Internet stocks during the Internet bubble, averaging at 25.9%, was significantly lower than it was for a sample of control firms, where it averaged 40.2%.<sup>94</sup> Moreover, they find that the median return on the first day of the IPO for Internet stocks is 125.4% when institutional trading is low versus only 27.1% when levels are high.<sup>95</sup>

One of the rationales given to the necessarily temporary nature of arbitrage opportunities is the unavoidable bankruptcy awaiting the irrational investors trading on the wrong side of the mispricing. This proposition has been challenged in financial economics literature. Different papers sought to demonstrate that less-than-fully-rational agents may accumulate more wealth than rational agents in the intermediate run, meaning they may not be going bankrupt so fast. As a result, the mispricing can continue for extended periods of time. De Long et al. show that overconfident risk-averse agents who underestimate risk will hold more of the risky asset than rational agents with correct beliefs.<sup>96</sup> Because the risky

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<sup>92</sup>Mark Mitchell et al., *Limited Arbitrage in Equity Markets*, 57 J. FIN. 551, 564 (2002).

<sup>93</sup>Andres Almazan et al., *Why Constrain Your Mutual Fund Manager?*, 73 J. FIN. ECON. 289, 296-98 (2004).

<sup>94</sup>Ofek & Richardson, *supra* note 87, at 1121.

<sup>95</sup>*Id.* at 1114. Note that block trading level is used as a proxy for the level of institutional trading.

<sup>96</sup>J. Bradford De Long et al., *The Survival of Noise Traders*, 64 J. BUS. 1, 17-18 (1991).

asset has higher expected returns, on average, these traders do well relative to the rational investors. Similarly, Hirshleifer and Luo construct a model where overconfident investors, who base their belief on correct information, underestimate risk and overestimate returns.<sup>97</sup> Again, trading strategies, in either a long or short direction, are more aggressive, and result in higher expected profits. Therefore, whether irrational investors can survive in the long run is likely to depend on the effects of the combination of two separate pathologies: the irrationality of their investment strategy causing higher returns when unadjusted for risk; and the limitations on the ability or willingness of rational arbitrageurs to take advantage of the irrationality.

*D. Bounded Rationality, Systematic Cognitive Biases,  
and Alternative Asset Pricing Models*

The validity of the efficient market hypothesis does not rest on the assumption that all investors are rational. What is crucial is that the income maximizing behavior of investment professionals and other informed traders leads them to take advantage of arbitrage opportunities by shorting overpriced securities and buying underpriced securities. Moreover, it is necessary that these arbitrageurs should face no capital constraints and have infinite horizons. More precisely, they must have sufficient capital and long enough horizons to await patiently the revelation of information or the reversal of sentiment underlying the mispricing.

In the presence of risks to arbitrage, the efficient markets hypothesis presumption would still be valid if the trading strategies of irrational and uninformed investors were uncorrelated so that their effect washes out in aggregate. The issue of whether noise traders have uncorrelated behaviors is one that has a somewhat indirect intellectual history. It starts with the marginally relevant documentation of a number of anomalies regarding cross-section average returns. First, returns tend to exhibit unconditional positive serial correlation at the short horizon of up to a year,<sup>98</sup> and negative correlation at long horizons.<sup>99</sup> Second, conditional on observable public events, such as earnings announcements, stock issues or repurchases and dividend initiations or omissions, returns exhibit a drift in the same

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<sup>97</sup>David Hirshleifer & Guo Luo, *On the Survival of Overconfident Traders in a Competitive Securities Market*, 4 J. FIN. MARKETS 73, 74 (2001).

<sup>98</sup>Narasimhan Jegadeesh & Sheridan Titman, *Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency*, 48 J. FIN. 65, 89 (1993).

<sup>99</sup>Werner F.M. DeBondt & Richard Thaler, *Does the Stock Market Overreact?*, 40 J. FIN. 793, 801 (1985).

direction as the initial reaction to the event.<sup>100</sup> Unlike the empirical violations of the law of one price, these results are based on research approaches that not only test the efficient markets hypothesis but also the underlying model of valuation including the appropriate risk-adjusted discount rate on future cash flows. Consequently, observing these patterns is not sufficient to defeat the presumption of reliance. Nonetheless, they served as motivation to consider models where the behavior of at least some investors is "irrational" in some way.

Early models replaced the assumption of investor rationality with assumptions that were only loosely based on the findings of psychologists working in the area of choice behavior. For example, in De Long's model, noise traders are assumed to hold false stochastic beliefs about the price of the risky asset.<sup>101</sup> These beliefs are random and they involve an expected price that is incorrect in some fundamental sense.<sup>102</sup> The mean misperception is a measure of the average "bullishness" of this class of traders.<sup>103</sup> This reduced form captures a sentiment that is the central tendency of the population of irrational investors, rather than idiosyncratic mistakes, resulting in systematic risk. It represents a cognitive process involving misinterpretation of pseudosignals coming, for example, from technical analysts or stockbrokers. Other models assumed non-maximizing strategies such as momentum trading. These were based on casual observations about "real world" investment strategies rather than documented psychological evidence.<sup>104</sup>

Since the mid 1990s, behavioral finance academics have become more careful in the aspects of irrationality that they assumed. They focused, in large, on well-documented elements in the psychology of decision making. Some economists doubt the strength of the supporting evidence and its relevance to financial markets.<sup>105</sup> Others, however, find

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<sup>100</sup>For a review, see Victor L. Bernard, *Stock Price Reactions to Earnings Announcements: A Summary of Recent Anomalous Evidence and Possible Explanations in ADVANCES IN BEHAVIORAL FINANCE* 303 (Richard H. Thaler ed., 1993).

<sup>101</sup>J. Bradford De Long et al., *Noise Trader Risk in Financial Markets*, 98 J. POL. ECON. 703, 705-06 (1990).

<sup>102</sup>See *id.*

<sup>103</sup>See *id.*

<sup>104</sup>See, e.g., J. Bradford De Long et al., *Positive Feedback Investment Strategies and Destabilizing Rational Speculation*, 45 J. FIN. 379 (1990); Harrison Hong & Jeremy C. Stein, *A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets*, 54 J. FIN. 2143 (1999).

<sup>105</sup>See, e.g., Rubinstein, *supra* note 53, at 16.

For example, if we discover that asset prices exhibit reversals (surprise of surprises), the behavioralists say the cause is the documented tendency of individuals to overreact to recent events. Of course that explanation could be

it compelling and robust. Below, this article reviews direct evidence inconsistent with rational investing and then discusses the main deviations from rationality that have found their way into behavioral finance models.

### 1. Observed Behavior Inconsistent with Rational Investing

The empirical literature on the behavior of individual investors is fairly recent. These studies offer evidence of systematic deviations from rationality that are consistent with evidence from psychology on the process of decision making. For example, Terrance Odean observed that investors sell their "winning" stocks too soon and hold their "losers" for too long.<sup>106</sup> This strategy results in average returns that are 4.4% lower than the average returns from the reverse strategy, whereby an investor sells a loser and buys a winner, over the year following the sale.<sup>107</sup> In a different study, Odean and Barber find that men trade 45% more than women and earn annual risk-adjusted net returns that are 1.4% less than those earned by women.<sup>108</sup> This is consistent with both the psychological evidence that men tend to be more overconfident than women in financial tasks, and with theoretical models predicting that overconfident investors will trade excessively.<sup>109</sup> Along the same lines, Odean and Barber find that investors who switched from phone-based to online trading experienced a significant decrease in their average return, from 2% to negative 3% annual excess return, due to excessive trading.<sup>110</sup> Benartzi and Thaler find that workers use simple "irrational" heuristics to select the portfolio of their retirement plans.<sup>111</sup>

The inability of professional money managers to outperform risk-adjusted index funds has been used as a defense of the efficient market

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true, but to believe it requires that we extrapolate from studies of *individual* decision making done in narrow and restricted conditions to the complex and subtle environment of the security markets.

*Id.*

<sup>106</sup>Terrance Odean, *Are Investors Reluctant to Realize Their Losses?*, 53 J. FIN. 1775, 1775 (1998).

<sup>107</sup>*Id.* at 1796.

<sup>108</sup>Brad M. Barber & Terrance Odean, *Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment*, 116 Q. J. ECON. 261, 261 (2001).

<sup>109</sup>*Id.*

<sup>110</sup>Brad M. Barber & Terrance Odean, *Online Investors Do the Slow Die First*, 15 REV. FIN. STUD. 455, 455 (2002).

<sup>111</sup>Shlomo Benartzi & Richard H. Thaler, *Naive Diversification Strategies in Defined Contribution Savings Plans*, 91 AM. ECON. REV. 79, 96 (2001). Investors use a simple strategy of "equal split" to allocate their investments between stocks and bonds in their 401-K. *Id.* This naïve form of diversification is sensitive to the framing of the saving plan because investors split equally across investment options rather than across risk categories. *Id.* Consequently, the riskiness of the portfolio is influenced by non-fundamental factors of the saving plan. *Id.*

hypothesis.<sup>112</sup> In fact, the data show that over the long term, actively managed mutual funds under performed the S&P 500 by almost 200 basis points per year.<sup>113</sup> There is another implication of this finding that is not so kind to the efficient market hypothesis. As stated by Malkiel: "Perhaps the more important puzzle today is why so many investors buy high-expense, actively managed mutual funds instead of low-cost index funds."<sup>114</sup>

By themselves, these findings only show that some biases are systematic in large populations of traders. Without a linkage to their effect on price formation they are not enough to dislodge the efficient market hypothesis. Moreover, evidence of cognitive biases in institutional investors would be even more persuasive—as subject for a later section.

## 2. Deviations From Rationality Supported by Psychological Evidence

The presence of at least some rational investors who have enough capital to short overpriced stocks effectively can compensate for there being a large sector of noise traders. A rational investor is assumed to maximize the expected stream of future utility. This assumes that: (1) expected utility is the correct measure for evaluating the attractiveness of risky assets; (2) investors are capable of evaluating correctly the probabilities of different possible states, incorporating into their assessments both public and private information. Psychologists have documented extensively situations where either of these assumptions is violated.

Moreover, the violations often show a systematic pattern. That is, many investors are biased in a similar manner. This view was reinforced by the seminal work of Amos Tversky and Daniel Kahneman.<sup>115</sup> Tversky and Kahneman demonstrated in a wide range of experiments that deviations

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<sup>112</sup>Malkiel, *supra* note 51, at 76-79. "For me, the most direct and most convincing tests of market efficiency are direct tests of the ability of professional fund managers to outperform the market as a whole." *Id.* at 76-77. As noted above, though, this is a test of the definition of efficient markets that is of less interest to the courts. The inability of fund managers to do better than throwing darts blindfolded is not the same as showing that shares are correctly priced.

<sup>113</sup>*Id.* at 78.

<sup>114</sup>*Id.* at 76.

<sup>115</sup>Many of the biases and heuristics most often cited are taken from the pioneering work of Amos Tversky and Daniel Kahneman on decision making. *See, e.g.*, Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 185 *SCIENCE* 1124 (1974); Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, 59 *J. BUS.* 251 (1986). Professor Kahneman, who is a member of the psychology department at Princeton University, became a Nobel Laureate in 2002 in economics (after Professor Tversky's death) for their joint contribution.

from rationality and expected utility theory are often systematic. Their results contested the assumption that these effects are likely to "wash out" in aggregate.

Although the finding that such cognitive biases are systematic is a complication for the efficient market hypothesis, it is precisely because they are systematic that they offer a structured alternative to the rational investor assumption. Many of the biases and heuristics documented by Tversky and Kahneman served as foundation to alternative models that allowed investors to deviate from rationality. We discuss briefly the violations and the alternative assumptions with respect to each of the components: preferences and beliefs.<sup>116</sup>

a. *Preferences*

Any model involving risk assumes a way in which investors evaluate risky gambles. The standard assumption is that investors look at the expected utility resulting from the gamble. Expected utility is equal to the product of the utility resulting from the wealth level in each possible state of the world multiplied by the probability that this state of the world occurs. There is a well-known set of normative axioms on preferences (and thus behavior) that justifies this form of expected utility. When faced with choice among risky gambles, however, people often act in a way that is inconsistent with expected utility theory. In fact, the experimental literature has a long tradition of documenting systematic violations. The most influential alternative—Prospect Theory—was motivated purely on its descriptive value. Prospect Theory was proposed by Amos Tversky and Daniel Kahneman in 1979 and was later developed in 1992 to accommodate more complicated gambles.<sup>117</sup> The theory accounts for a large set of observed violations.

The empirically derived functional form of the value function, replacing the standard utility function, has three notable characteristics:

1. Gambles are evaluated by the gains and losses they imply rather than the final wealth levels they induce. For example, suppose that your current wealth is

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<sup>116</sup>For a more complete list of biases and evidence the reader is referred to the recent surveys by Barberis and Thaler and Hirscheleifer (Barberis & Tahler, *supra* note 50; Hirscheleifer, *supra* note 62), as well as the collection of papers edited by Amos Tversky and Daniel Kahneman, *CHOICES, VALUES AND FRAMES* (Daniel Kahneman & Amos Tversky eds., 2000).

<sup>117</sup>Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, 47 *ECONOMETRICA* 263 (1979); Amos Tversky & Daniel Kahneman, *Advances in Prospect Theory: Cumulative Representation of Uncertainty*, 5 *J. RISK UNCERTAINTY* 297 (1992).

\$250,000. Under experimental conditions it is likely that if you are offered a 50:50 chance of winning \$10 or losing \$10 you consider the tradeoff between a gain of \$10 and a loss of \$10 rather than the expected utility of an equal chance of having \$250,010 or \$249,990.<sup>118</sup>

2. The second component, going under the name of loss aversion, is that losses loom larger than gains. In particular, the associated displeasure from losing \$10 is roughly twice as large as the associated pleasure from winning \$10.
3. Third, people are risk averse when gains are involved while they are risk loving when losses are involved. For example, they will prefer taking a sure gain of \$5 over a 50:50 chance to win \$10; at the same time, they will prefer a 50:50 chance of losing \$10 over a sure loss of \$5.
4. The final component is that probabilities are distorted when used to evaluate the prospects of a gamble. The "expected value" is equal to the sum of products of the value of each outcome and the transformed probability of the outcome.

Notwithstanding all of the above, the first two components are often sufficient to explain phenomena involving mispricing.<sup>119</sup> For example,

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<sup>118</sup>Matthew Rabin provided a striking argument against expected utility maximization. Matthew Rabin, *Risk Aversion and Expected-Utility Theory: A Calibration Theorem*, 68 *ECONOMETRICA* 1281, 1286-89 (2000). Using a calibration argument he shows the following. Suppose that an investor turns down a gamble that puts equal probabilities on a loss of \$100 and a gain of \$110 when his initial wealth is below \$300,000. *Id.* at 1285. Assuming that the investor is an expected-utility maximizer implies he must also turn down a gamble that puts equal probabilities on a loss of \$4000 and a gain of \$60 million, when his initial wealth is at most \$290,000. *Id.* Indeed the degree of concavity of his utility function, implied by the rejection of the small-scale lottery, has a drastic aggregate effect when the stakes are multiplied. *Id.*

<sup>119</sup>Shlomo Benartzi and Richard Thaler explain the equity premium puzzle, i.e., that the return on stocks is higher than the return on bonds by an amount that cannot be explained by traditional asset pricing theory, by arguing that frequent evaluations of a portfolio result in returns that are often not representative of the average returns. See Shlomo Benartzi & Richard Thaler, *Myopic Loss Aversion and the Equity Premium Puzzle*, 110 *Q. J. ECON.* 75, 85-87 (1995). Along with loss aversion, this implies that investors require higher compensation for holding risky stocks. *Id.* The premium goes down towards a figure that is consistent with standard asset pricing models as the evaluation periods get sufficiently long. *Id.*

Shiller argues that loss aversion is likely to be part of the explanation why investors tend to shy away from shorting stocks.<sup>120</sup> Foreseeing the psychologically painful possibility of closing a short position at a (potentially unbounded) loss, investors prefer not to put themselves in this position.<sup>121</sup>

An example where the third characteristic plays a role is the "disposition effect," associated with the tendency of investors to hold their losing stocks for too long while selling their winning stocks too soon. Stated differently, this suggests that investors prefer a sure gain (by selling a winner stock today) over taking a gamble (by holding it for one more period). At the same time, they prefer taking a gamble (by holding a losing stock for one more period) over realizing a sure loss today (by selling the stock).<sup>122</sup> This difference in the attitude to risk depending on whether gains or losses are concerned is the essence of the third property of Prospect Theory.

#### b. *Beliefs*

The second component of rationality requires that investors revise their beliefs in a correct manner in light of new information. In particular, when information has some random component associated with it, i.e., it is noisy, the investor should take into account this degree of imprecision and its implications on the variance of returns. While there are many documented biases in belief formation, the strongest evidence is in support of *overconfidence*.<sup>123</sup> Alpert and Raiffa found that people tend to

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<sup>120</sup>Shiller, *supra* note 56, at 100.

<sup>121</sup>*Id.* at 85.

<sup>122</sup>There is also interesting evidence from the real estate market that is consistent with the "disposition effect" suggesting sellers are less likely to sell at a price below their purchase price. See David Genesove & Christopher Mayer, *Loss Aversion and Seller Behavior: Evidence from the Housing Market*, 115 Q. J. ECON. 1233 (2001).

<sup>123</sup>Werner F.M. DeBondt and Richard H. Thaler state: "Perhaps the most robust finding in the psychology of judgment is that people are overconfident." Werner DeBondt & Richard Thaler, *Financial Decision Making in Markets and Firms: A Behavioral Perspective*, in 9 FINANCE, HANDBOOKS IN OPERATIONS RESEARCH AND MANAGEMENT SCIENCE 389 (Robert A. Jarrow et al., eds. 1995).

There is a fairly extensive list of additional biases that were documented in the psychology literature. Many biases, including *representativeness* and the *law of small numbers*, date back to Kahneman and Tversky's *Judgment Under Uncertainty*. Representativeness asserts that people evaluate the probability that an object A belongs to a class B by assessing the degree to which A is representative of B. By doing so they neglect to take into account the base rate probability, i.e., the likelihood of class B. Let us illustrate this by re-phrasing the famous experiment by Kahneman and Tversky in the context of the stock market. Suppose investors hear the following information about a company, QuickLab, that they have never heard of before:

overestimate the precision of their knowledge—they assign confidence intervals to their estimates that are much too narrow.<sup>124</sup> Moreover, people are most likely to be overconfident in answering questions of moderate to extreme difficulty. Further, experts evidence more overconfidence than relatively inexperienced individuals<sup>125</sup>—a finding that should give pause to those who believe institutional investors can bring mispriced stocks into line. Models in behavioral finance have adopted the overconfidence

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QuickLab is a new and innovative company. Tim and Josh, the founders, have been good friends since graduate school. Upon graduation from Stanford University Computer Science Department they decided to turn their highly appraised final project into a real product. They were able to raise venture capital from Bay Area sources to get their operation through initial development. Their business plan looks solid, implementation of the second generation of the product is progressing smoothly and prospects for future market share are promising.

An investor, deliberating whether to acquire stocks of the company shortly following the IPO, implicitly considers the ranking of the following three statements by their likelihood:

- A: QuickLab will soon be a well-received IPO.
- B: QuickLab is in an Internet related business and it will soon be a well-received IPO.
- C: QuickLab is in an Internet related business.

Kahneman and Tversky's prediction is that investors will rank C first, i.e., as the most likely, B second and A third. While it is quite possible that C is more likely than A, it is impossible that B is more likely than A. Moreover, the more representative the description is of an Internet company the closer the estimates of B and C. This overestimate of the likelihood of B results from overweighing the probability that QuickLab is an Internet company and underestimating the base-line probability of a randomly chosen company being an Internet company. This may lead to overly optimistic investments in the company.

The law of small numbers is a fallacy whereby decision makers believe that the law of large numbers applies to small samples. In statistics, the law of large numbers implies that a sufficiently large sample of a random variable should be representative of the mean. Moreover, sufficiently long string of draws should look representative of the distribution. Decision makers who falsely expect these properties to be true for small samples are likely to have undue confidence in early trends (e.g., the outcome of the first few draws) and in the stability of observed patterns. They will overestimate significance. In evaluating replications, they have unreasonably high expectations about the replicability of significant results.

Informally speaking, if investors believe in the law of small numbers and they observe a sequence of hot IPOs, they are likely to believe they represent a true new state of the economy rather than a sequence of random successes. They will expect the next few IPOs especially if they focus on forecasting the likelihood that a smaller sample of coming IPOs will be hot. Stated this way, this bias gives rise to behavior that resembles momentum trading. Note that the presence of this bias in investors may be self-fulfilling. That is, the optimistic views of those making the forecasts play a role in contributing to the eventual likelihood that the next IPO is indeed a hot one.

<sup>124</sup>Marc Alpert & Howard Raiffa, *A Progress Report on the Training of Probability Assessors*, in JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 294 (Daniel Kahneman et al. eds., 1982).

<sup>125</sup>Dale Griffin & Amos Tversky, *The Weighing of Evidence and the Determinants of Confidence*, 24 COGNITIVE PSYCHOL. 411, 430 (1992).

assumption, arguing that financial markets resemble situations in which overconfidence is often observed—forecasts are complex, many investors consider themselves experts and feedback, measured through earned returns, is noisy, all together making learning a difficult task. The overconfidence assumption is usually modeled as unrealistically lower estimates of the variance of one's own private information and, consequently, of one's forecast error. Models with overconfident investors have been used to explain some of the cross-section returns anomalies as well the emergence of speculative bubbles as we further discuss below.

### 3. Asset Pricing Models that Explain Why Investors Knowingly Buy Overpriced Stock

A number of alternative models give rise to overpricing. They can be roughly classified under two categories. In the first, while there may be a small group of boundedly-rational investors, there are sufficiently many rational arbitrageurs. Notwithstanding this, the rational arbitrageurs do not offset the mispricing. Quite the opposite, they may choose to "join the party" and hold long positions in the overpriced stock, thereby exacerbating the mispricing. An important consequence of such models is that known overpricing caused by misinformation does not necessarily prevent investors from buying the security.

The second class of models assumes that some group of investors is irrational. The investors may be similar to one another in their misperceptions, or they may be of different types. The irrational aspects of investors' behavior affect the assimilation of information and prices, resulting in a mispricing. In these models, again, the behavioral presumption is inconsistent with the view that investors would not willingly buy a stock that is overpriced because of misinformation in the market.

#### a. *Bubbles in Markets with Rational Arbitrageurs*

An interesting attack on the efficient market theory came from academics arguing that rational traders could create a price that did not reflect the underlying value of a company. The essence of the theory is that it is rational to overpay for a stock if you believe that you can later sell the stock to someone else and recoup your overpayment—something described colloquially as the "greater fool theory," and in the academic literature as a theory of rational bubbles.<sup>126</sup>

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<sup>126</sup>Olivier J. Blanchard & Mark W. Watson, Bubbles, Rational Expectations and Financial Markets (Nat'l Bureau of Econ. Research, Working Paper No. 945, 1982).

A simple illustration of the workings of a rational bubble is as follows. Assume, for simplicity, that an investor is risk neutral and that the risk-free interest rate is zero. Suppose that a stock has a fundamental value of \$10 per share based on publicly available information but is trading today at \$12. A reason for investors to be willing to pay \$12 today is that they foresee that over some time frame, say a year for simplicity, the bubble has a 50% chance of bursting and sending the stock back to \$10 and a 50% chance of doubling so that the stock price goes to \$14. The expected value of the stock in a year is then \$12, which matches the stock price today. The value of \$14 a year from now is justified by the assumption that the same process will continue, with the stock either going up to \$18 two years from today or dropping back to \$10.<sup>127</sup> In a rational bubble, there is no guarantee that knowing the price of the stock is above its fundamental value for a combination of reasons will stop a reasonable investor from buying.

The rational bubble theory helps highlight the difference between the two basic definitions of the efficient market hypothesis. When a rational bubble exists, the stock price does not reflect the fundamental value of a company. Nevertheless, an investor should not count on a positive risk-adjusted return by shorting the stock because it is a reasonable expectation that the probability-weighted gains, which equal the product of the likelihood that the bubble continues times the excess returns, are just offset by the expected losses, calculated in the event that an investor is holding the stock when the bubble bursts.

While the above argument explains why arbitrageurs may be willing to acquire an inflated security, it leaves unexplained the issue of how the misperception comes about in the first place and what drives it to follow the required price path to make it viable. The common wisdom among academics is that when (1) markets are complete; (2) there are no differences in information; and (3) all investors are rational, a bubble is not viable in equilibrium.<sup>128</sup> However, the presence of either noise traders in the market and/or information asymmetries that are sufficient to sustain

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<sup>127</sup>The theory can easily accommodate dividends (through the valuation of the fundamental value) and concerns such as positive interest rates or risk aversion by varying the growth rate of the bubble and/or the probability that the bubble will burst. Hence, the current price of the stock can still be justified based on the potential future paths of the "bubble" component in the price.

<sup>128</sup>Bubbles cannot emerge for assets with a finite maturity because the equilibrium price of the asset must coincide with its cash liquidation value at the time of maturity. Using backwards induction to unfold the beliefs and behavior of investors from that day to prior dates, pins down equilibrium prices to fundamental values. An asset with infinite maturity may be in a bubble, in which case the bubble must grow at the risk-free interest rate in equilibrium. This implies that the expected price grows to infinity with time. Finite wealth and rationality of investors, however, deem such a price path impossible in equilibrium.

difference of opinions among investors may allow the emergence of a price bubble.

### 1. Noise Traders and Systematic Risk

Earlier in this article we presented De Long et al., "Noise Traders in Financial Markets,"<sup>129</sup> where a mispricing arose due to the sentiment of a small group of investors, labeled "noise traders." In particular, the noise traders' assessment of the current price is subject to a random but common bias. As a result, when noise traders are bullish the asset is overpriced.<sup>130</sup> Notwithstanding this, rational arbitrageurs are willing to hold long position in the stock when they forecast that the price in the next period is going to be sufficiently high.<sup>131</sup> Both types of investors, however, hold different opinions regarding next period's returns.<sup>132</sup> In the absence of uncertainty regarding the price of the stock tomorrow, which is due to tomorrow's sentiment of noise traders, the difference in opinions between rational traders and noise traders today would have driven them to want to take an infinite bet against each other, causing any equilibrium to break down.<sup>133</sup> The presence of a systematic risk regarding tomorrow's price, however, implies that neither the arbitrageurs nor the noise traders are willing to hold sufficiently large positions, thereby allowing today's mispricing to continue.<sup>134</sup>

### 2. Coordination Failure

Abreu and Brunnermeier formalize the idea that it takes a collective disbelief in a bubble to burst it.<sup>135</sup> More specifically, if financial constraints limit the stock holding and short position of each individual arbitrageur, it requires a critical mass of investors to exit the market before a correction occurs.<sup>136</sup>

Consequently, if the beliefs of rational traders are sufficiently different (presumably due to private information inasmuch as prices are

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<sup>129</sup>De Long et al., *supra* note 100.

<sup>130</sup>*Id.* at 711.

<sup>131</sup>*Id.*

<sup>132</sup>*Id.* at 712.

<sup>133</sup>De Long et al., *supra* note 100, at 710.

<sup>134</sup>*Id.*

<sup>135</sup>Dilip Abreu & Markus K. Brunnermeier, *Bubbles and Crashes*, 71 *ECONOMETRICA* 173, 176 (2003).

<sup>136</sup>*Id.* at 174.

public) they may "fail" to coordinate on exiting the market.<sup>137</sup> More specifically, suppose that different arbitrageurs get private signals about the existence of a mispricing and the time in the future in which it is surely to disappear.<sup>138</sup> However, they do not know how many others have already gotten the news, and, in particular, whether this is a large enough crowd to burst the bubble.<sup>139</sup> Depending on the time in which they receive the information, different arbitrageurs will hold different opinions regarding the remaining time before the bubble is likely to burst.<sup>140</sup> Because they know that it takes a synchronized action to actually burst the bubble, they may assess that the probability of this happening in the next period is relatively small.<sup>141</sup> The rationale for riding the bubble is then clear—arbitrageurs want to buy the inflated stock and stay in the market until the subjective probability they assign for the market to crash the following period is sufficiently high.<sup>142</sup> Those who exit the market shortly before it crashes profit the most, those who exit too early forego some profits, while those who stay too long, holding their stocks at the time of the crash, lose money.<sup>143</sup>

### 3. Rational Herding and Informational Cascades

Herding behavior is often associated with people blindly following the decisions of others. There is a variant of this behavior that may be rational, however, as it leads to higher expected payoffs. This can come about due to the payoff structure of the interaction or due to information externalities. Examples of the former are situations where a coordinated action leads to higher payoffs. In this section we will focus on herding due to information externalities.

Herding will refer to a situation where an investor chooses to ignore his private information and follow the (possibly inefficient) behavior of preceding investors.<sup>144</sup> This pattern of behavior is also referred to as information cascades because individuals' actions do not reveal any information to later investors and thus their actions impede information

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<sup>137</sup>*Id.*

<sup>138</sup>*Id.*

<sup>139</sup>Abreu & Brunnermeier, *supra* note 135, at 174.

<sup>140</sup>*Id.*

<sup>141</sup>*Id.*

<sup>142</sup>*Id.*

<sup>143</sup>Abreu & Brunnermeier, *supra* note 135, at 174-75.

<sup>144</sup>Abhijit V. Banerjee, *A Simple Model of Herd Behavior*, 107 Q. J. ECON. 797, 798 (1992).

aggregation.<sup>145</sup> Two papers initiating this strand of the literature were written independently: one by Abhijit Banerjee and the other by Bikhchandani, Hirshleifer and Welch in 1992.<sup>146</sup> Herding in these models is an outcome of the attempt of rational agents to infer private information of others from their observed behavior.

Consider the following scenario: agents receive some private (noisy) information on the quality of different stocks. Information arrives sequentially, with each investor making his decision after receiving his private information and observing the investment decisions already taken by investors who have received their information earlier. Note, however, that the investor only gets to observe the actions taken by previous investors rather than their private information. In a world of this type, a piece of information on a certain stock, possibly useless due to noise, that arrives early may have a substantial (and nonreversible) effect on the behavior of an entire crowd of investors. More specifically, it leads the investor who receives the news to acquire the stock. Moreover, it may cause subsequent investors to *rationally* decide that the information received by prior investors, partially revealed through their investments, outweighs their own private information. Consequently, an investor may choose to acquire the same stock as those before him, overriding his private information pointing to a potentially better stock. When an investor first decides to override his own private information, it is rational for subsequent investors to "herd" as well. Consequently, herding toward an inferior stock may well occur.

Had the *information* received by prior investors been observable rather than their *actions*, efficient aggregation of information would have prevailed. Subsequent investors would then be in possession of the observed information that would be sufficient to infer which is the stock with the highest true value.

b. *Bubbles in a Market with Cognitive Biases*

1. Divergence of Opinions and Overconfidence

In 1978, Harrison and Kreps proposed a simple model that illustrated the possibility of a speculative bubble in a market where investors hold

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<sup>145</sup>Sushil Bikhchandani et al., *A Theory of Fads, Fashion, Custom, and Cultural Change as Information Cascades*, 100 J. POL. ECON. 992, 994 (1992).

<sup>146</sup>Banerjee, *supra* note 144; Bikhchandani, *supra* note 145.

different (and incorrect) beliefs.<sup>147</sup> They showed that if investors are unable to sell short, this dispersion of opinions is sufficient to generate a path of prices that are above the price that any investor would have been willing to pay for the stock if he were obliged to hold it forever.<sup>148</sup> This additional component in the price results from what they refer to as speculative reasons.<sup>149</sup> Investors acquire a long position in the stock at an inflated price because they (correctly) believe that others will be willing to pay an even higher price at some point in the future.<sup>150</sup>

Scheinkman and Xiong, developing this insight, constructed a model where a bubble emerges as a result of a dispersion of opinions among investors.<sup>151</sup> Rather than simply assuming a dispersion of opinion, they show that it naturally arises out of overconfidence of investors regarding the quality of their private information.<sup>152</sup> Consequently, overconfidence, which is considered to have strong support in the psychology literature and in microdata on investors' behavior, may generate a disagreement among otherwise rational investors in the market to a degree that, in the presence of short sale constraints, may lead to a speculative bubble.<sup>153</sup>

## 2. Momentum Traders

A model presented by Hong and Stein in *A Unified Theory* is an attempt to highlight the interaction between different types of boundedly-rational investors.<sup>154</sup> The population of investors is assumed to be composed of two types, newswatchers and momentum traders.<sup>155</sup> Each type is capable of making imperfect inferences from prices and public

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<sup>147</sup>J. Michael Harrison & David M. Kreps, *Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations*, 92 Q. J. ECON. 323 (1978). Harrison and Kreps assumed this heterogeneity of expectations without modeling why it may come about and whether it is likely to disappear with time. Stephen Morris investigated the price path where agents start with different priors on the dividend process and then learn over time. Stephen Morris, *Speculative Investor Behavior and Learning*, 111 Q. J. ECON. 1111 (1996). He characterizes the degree in which prior beliefs need to be different for a bubble to emerge and persist forever. *Id.* at 1111-13. While learning implies that beliefs converge to the truth and consequently, prices converge to fundamental value, the mispricing in the intermediate run may be significant. *Id.*

<sup>148</sup>Harrison & Kreps, *supra* note 147, at 323-24.

<sup>149</sup>*See id.*

<sup>150</sup>*Id.*

<sup>151</sup>José A. Scheinkman & Wei Xiong, *Overconfidence and Speculative Bubbles*, 111 J. POL. ECON. 1183 (2003).

<sup>152</sup>*Id.* at 1183-87.

<sup>153</sup>*Id.*

<sup>154</sup>*See* Hong & Stein, *supra* note 104, at 2143.

<sup>155</sup>*Id.* at 2144.

information to fundamental value.<sup>156</sup> The newswatchers can forecast the fundamentals based on their private information, however, they neglect to condition their decisions on current or past prices.<sup>157</sup> Also, information is assumed to diffuse gradually among newswatchers, so that it takes some time until all of them have all the relevant information.<sup>158</sup> Momentum traders invest in response to the last change in price.<sup>159</sup> That is, if the price of the asset has increased from last period, they will acquire long position in the asset.<sup>160</sup> They do not rely on any other information.<sup>161</sup>

Imagine that there is a public announcement of good news at date  $t$  and no change in the fundamentals thereafter.<sup>162</sup> The newswatchers cause the price to jump at time  $t$ .<sup>163</sup> In the next period,  $t+1$ , momentum traders, who detect the price increase in the previous day, buy the stock and make money.<sup>164</sup> This round of purchases increases the price even higher, causing momentum traders entering the market in period  $t+2$  to buy the stock as well.<sup>165</sup> As a result of the demand generated by momentum traders, the price of the stock eventually goes above its fundamental value (conditional on the good news).<sup>166</sup> At this point, only momentum traders buy the inflated stock and consequently lose money.<sup>167</sup>

#### IV. IMPLICATIONS ON SHAREHOLDER CLASS ACTIONS OF ALTERNATIVE THEORIES OF MARKETS FOR ACTIVELY TRADED SECURITIES

We now consider how a departure from the efficient market hypothesis and adoption of alternative theories on price formation would impact some of the analyses common to most shareholder class action claims.

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<sup>156</sup>*Id.*

<sup>157</sup>*Id.* at 2144-45.

<sup>158</sup>Hong & Stein, *supra* note 104, at 2145.

<sup>159</sup>*Id.*

<sup>160</sup>*Id.*

<sup>161</sup>*Id.*

<sup>162</sup>Hong & Stein, *supra* note 104, at 2145.

<sup>163</sup>*Id.*

<sup>164</sup>*Id.* at 2145-56. Newswatchers may continue to buy the stock as well as more good information diffuses among them.

<sup>165</sup>*Id.* at 2146.

<sup>166</sup>Hong & Stein, *supra* note 104, at 2146.

<sup>167</sup>*Id.*

A. *The Importance of Using the Right Definition of the Efficient Market Hypothesis*

The distinction between (1) incorporating information correctly (fundamental efficiency) and (2) not being able to beat the market armed only with publicly available information (informational efficiency) was usually not explicit as of 1988 when the Court decided *Basic*. Nonetheless, there is little doubt that the Court had in mind an objective concept of value when it rendered its opinion:

Thus the market is performing a substantial part of the valuation process performed by the investor in a face-to-face transaction. The market is acting as the unpaid agent of the investor, informing him that given all the information available to it, the value of the stock is worth the market price.<sup>168</sup>

This is different from the concept of informational efficiency which is limited to the hypothesis that it is not possible for any investor to profit from arbitrage based on his information set. As discussed above, however, informational efficiency does not mean that a stock price will correctly incorporate all relevant information.

The dichotomy presents a conundrum. The definition of the efficient market hypothesis that is most supportive of the fraud-on-the-market theory is most often the more difficult of the two to test empirically. As noted above, there are occasions when the structure of securities allows a test for violations of the law of one price, such as when there are carve-outs. Absent such circumstances, a test of mispricing would require one to test whether the true value of a company was tolerably close to the market

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<sup>168</sup>*Basic*, 485 U.S. at 244 (citing *In re LTV Sec. Litig.*, 88 F.R.D. 134, 143 (N.D. Tex. 1980)); accord, e.g., *Peil v. Speiser*, 806 F.2d 1154, 1161 (3d Cir. 1986) ("In an open and developed market, the dissemination of material misrepresentations or withholding of material information typically affects the price of the stock, and purchasers generally rely on the price of the stock as a reflection of its value."). White's dissent agrees that the opinion implies that stocks have an objective value.

To define the term "integrity of the market price," the majority quotes approvingly from cases which suggest that investors are entitled to "rely on the price of a stock as a reflection of its value." But the meaning of this phrase eludes me, for it implicitly suggests that stocks have some "true value" that is measurable by a standard other than their market price. While the scholastics of medieval times professed a means to make such a valuation of a commodity's "worth," I doubt that the federal courts of our day are similarly equipped.

*Basic*, 485 U.S. at 255 (White, J., dissenting) (footnote omitted).

price. For example, a persuasive observation of mispricing occurs if the market price is so high that it implies an unreasonably high projection of future free cash flow.<sup>169</sup> Under most circumstances, however, such a test is challenging, as discounted cash flow projections allow for a range of input choices that, correspondingly, yield a range of possible valuation outcomes. Moreover, even assuming that one finds mispricing, the test may have to be performed for more than one date during the class period to see if the price remained greater than the underlying value of the company.

The other definition of the efficient market hypothesis, that one cannot obtain risk-adjusted above-market returns, has the benefit of being easier to test. This, however, is the definition that does not prove that the market price *correctly* incorporated all information; just that new information does not continue to affect price changes in some determinative way after its initial impact.

*B. Reliance: "Who Would Knowingly Roll the Dice  
in a Crooked Crap Game?"*

As described above, a fraud claim requires that plaintiff relied on the misstated information in making the decision to trade the stock. In the most common case where it is alleged that stock price has been inflated by a fraud, this implies that had the correct information been known to plaintiff, a purchase would not have been made at the price of the actual trade. Under the efficient market hypothesis, misrepresentation of information regarding the fundamental value of the stock causes the perceived value of the company to diverge from its true value. In the case of falsely positive news, the news increases the willingness of investors to pay higher prices for the stock, and thus translates into a higher stock price. It is implicitly assumed that a rational investor should take advantage of a known mispricing by taking a short position in the stock. Even if the investor is not able or willing to take a short position in the stock then acquiring the overpriced stock is assumed to be inferior to the alternative of not acquiring it at all. That is, the investor would either stay out of the market or acquire a close substitute that is unaffected by the false news. Based on this line of reasoning, an investor who is unaware of the misrepresentation relies on the price of the stock as fully reflecting available information and would not have invested knowing that the price inflated by falsely positive, material information.

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<sup>169</sup>There were a number of such observations made in the financial press about the market price of Amazon and other Internet retailers during the Internet bubble.

## 1. The Reliance Counterfactual

The *Basic* Court placed a great deal of faith in an implied counterfactual when it found the efficient market presumed reliance. That is, knowing privately that material information is incorrect, an investor would have either taken a short position or would have stayed out of the market. Presumably, the Court's answer would not have been very different for an alternative counterfactual asking what the investor would have done if others knew of the misrepresentation as well. The Court's theory has two corollaries: if actions of other informed investors do not cause the price to reflect available information, then any single investor would not have acquired the stock; and, if the price fully reflected available information without the misrepresentation being public, then the misrepresentation could not have been material.

Once we depart from the assumptions underlying the efficient market theory, the implied counterfactuals are different and may be important in the determination of reliance. In particular, how many others are assumed to be aware of the misrepresentation may play a role in shaping investors' beliefs and, consequently, in evaluating the impact of the information on prices.

When considering the counterfactual, one attempts to answer the questions: How would a rational investor have reacted *knowing* that a statement is a material misrepresentation? What should be learned from this regarding future prices? The rational investor's *beliefs* about how the false statement would affect the behavior of other investors in the market are a crucial factor. In particular, if plaintiff investors believe that there are sufficiently many (potentially irrational) investors that do not rely on information about the issuer (e.g., they are momentum traders and so they act only on the basis of past returns) then plaintiffs' beliefs about future prices may be the same regardless of their awareness of the misrepresentation. If this is the case, then no matter whether in fact other investors are actually aware of the misrepresentation, the plaintiffs' behavior would have been the same had they been aware of the misrepresentation. Therefore, they fail the test of reliance.

Alternatively, the plaintiffs may think that other investors are rational and attentive to key news regarding the issuer. Nonetheless, they may be unsure as to exactly how many other investors are aware of the misrepresentation. In the event that each of them individually is unwilling to take a short position sufficient to instantaneously offset any possibly mispricing, their forecasts regarding future prices may well depend on the fraction of others that are in the same position as themselves. For example, it may well be that as long as they believe that only a few others are aware

of the mispricing, they think that the bubble is likely to persist and so they are willing to acquire the overpriced security. Since, as we have argued at length, there are many situations in which informed investors might not be willing to take advantage of such an arbitrage, the inference as to what they would have done, and therefore whether they pass the test of reliance, may be sensitive to what form of the counterfactual we consider. That is, whether they pass the test of reliance may well depend on how many would have been aware of the misrepresentation in the "but for" world—the investor alone, a few or everyone?

## 2. Lack of Reliance Caused by Lack of Close Substitutes in a Bubble

When investors expect the risk-adjusted return of a security to be higher than that of available alternatives, they would be willing to acquire a long position in that security. Consequently, it may well be that, even if investors are aware of the misrepresentation, they choose to purchase the stock and, thereby, fail the test of reliance.

The belief that the risk-adjusted expected return on an inflated stock is likely to be higher than that of alternatives is more likely to happen when the misrepresentation has direct or indirect effect on close substitutes as well.<sup>170</sup> Moreover, the perception that an entire sector of stocks is inflated is reinforcing. First, the lack of a good theory and measures of fundamental value is likely to cause arbitrageurs to focus on "relative" mispricing. Therefore, it may well be that while all prices are inflated above the "absolute" values, there are no "relative" mispricings, making it hard, if not impossible, for investors to detect arbitrage opportunities. Second, the lack of unaffected close substitutes contributes to the willingness of rational investors to hold long positions in this sector, failing to correct mispricing in informationally inefficient stock.

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<sup>170</sup>*In re Initial Public Offering Sec. Litig.*, 241 F. Supp. 2d 281 (S.D.N.Y. 2003) (referring to a comprehensive SEC report).

Generally, the abuses found in a hot issues market involve either artificial restrictions on supply or attempts to stimulate demand that facilitate a rapid rise in the price of a security. . . . This practice stimulates demand for a hot issue in the aftermarket, thereby facilitating the process by which stock prices rise to a premium.

*Id.* at 305 (quoting Report of the SEC Concerning the Hot Issues Markets (Aug. 1984)). The conclusion that such restrictions on quantities translate into price inflation in the aftermarket is only plausible in the absence of close substitutes for rational investors to acquire instead of the affected securities.

The study by Lamont and Thaler indirectly performs the test of reliance for some stocks during the Internet bubble of the late 1990s.<sup>171</sup> In one telling example they claim:

[O]ne money manager told us (discussing stub situations in general) that although he was well aware that a particular subsidiary was overpriced relative to the parent, he could not buy the cheaper parent instead of the subsidiary because he ran a growth fund, and the cheaper stock was, by definition, value!<sup>172</sup>

Incremental overpricing of an entire class of stocks allegedly caused by defendants would, by its nature, affect potential substitutes. For investors whose investment objectives included this class of securities, there would not be good substitutes because, by definition, the other securities would have risk/reward characteristics different from this group. Consequently, if some plaintiffs were to know privately the scope of the alleged misrepresentations, they still would have purchased the (inflated) security based on a rational calculus that its expected return was better than could be earned from a substitute security, even after accounting for the anticipated decrease in price upon future disclosure of the information.

### 3. Lack of Reliance by Rational Investors

While it is well understood why optimistic views regarding future prices of an inflated stock drive investors to acquire the stock, the origin of these rosy beliefs so far remains unexplained. Two different types of investors, rational (and fully informed) and boundedly rational, can hold optimistic beliefs for very different reasons.

#### a. *Ignoring Information About the Issuer in a Rational Bubble*

First, rational investors can correctly gauge that the market is plainly optimistic without, necessarily, a basis from the information in the market. As Shiller describes it:

there was a focusing of public attention and talk on the speculative market and a proliferation of wishful-thinking theories about a "new era" that would propel the stock market

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<sup>171</sup>Lamont & Thaler, *supra* note 64.

<sup>172</sup>*Id.* at 262.

on a course that, while uneven, is relentlessly upward, theories that were spread by word of mouth as well as the media.<sup>173</sup>

An interesting insight into the beliefs of individual and institutional investors during the Internet bubble (and subsequent crash) comes from looking at different confidence indexes.<sup>174</sup> From April 1999 until April 2000, roughly 75% of individual investors expected the market to go up over the succeeding year.<sup>175</sup> Among institutional investors this number was significantly lower, averaging about 58.6%.<sup>176</sup> This suggests that while institutional investors were significantly less optimistic, their actions, presumably reflecting their beliefs, were not sufficient to reverse the upward trend of the market. At the same time the crash confidence index, i.e., the confidence that there will be no stock market crash in the succeeding six months, was reaching an all-time low of 30.7% for individual investors, and averaging roughly 26% for institutional investors.<sup>177</sup> Most strikingly, confidence in the valuation of the market drastically trended downwards for both individual and institutional investors reaching a common all-time low of roughly 30%.<sup>178</sup> The most plausible interpretation of these facts is that while most individual investors did not believe that prices were representative of the true valuations, they did believe that the bubble was likely to persist.

In "Bubble Investors: What Were They Thinking?" Dhar and Goetzmann report the results of a survey they conducted on investors' beliefs during 1999-2000.<sup>179</sup> They surveyed targeted investors who bought stock in a telecommunication company at least once during this time period.<sup>180</sup> The vast majority of the investors (674 out of 845) thought that it was likely (ranging from somewhat likely to extremely likely) that the price of an individual stock is higher or lower than its true value.<sup>181</sup> A large

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<sup>173</sup>Shiller, *supra* note 56, at 95.

<sup>174</sup>The data are taken from Yale International Center for Finance, Stock Market Investor Behavior Project, under the direction of Robert Shiller. Yale School of Management Stock Market Confidence Indexes, *available at* <http://icf.som.yale.edu/confidence.index> (last visited Mar. 8, 2006).

<sup>175</sup>*Id.*

<sup>176</sup>*Id.*

<sup>177</sup>*Id.*

<sup>178</sup>Yale School of Management Stock Market Confidence Indexes, *supra* note 175.

<sup>179</sup>Ravi Dhar & William N. Goetzmann, *Bubble Investors: What Were They Thinking?* (Yale ICF Working Paper No. 05-01, 2005).

<sup>180</sup>*Id.* at 8.

<sup>181</sup>*See id.* at tbl. B-4.

number of these investors identified their own research or opinions of their broker or financial advisor as the single most important factor in determining whether the price of the stock differs from its fundamental value.<sup>182</sup> When asked, "How often have you purchased a stock that at the time seemed overvalued but you purchased it any way because you thought that the price was likely to go even higher?" 15% replied "Often" or "Very often" and additional 40% said "Sometimes."<sup>183</sup> These replies are consistent with theories of bubbles in markets with rational arbitrageurs discussed earlier in the article.<sup>184</sup>

Clearly, a large fraction of rational investors were in the market exactly because they thought that others were optimistic about the stock. Many of these same investors also thought that the price was overvalued in the same way that the *Basic* Court found a fraud would overvalue a stock. *In either case, the explicit hypothesis of the Court that no one would buy such a stock is demonstrably rejected.* A telling quote about riding a bubble comes from the presumably very rational Stanley Durckenmiller, who managed George Soros' \$8.2 billion Quantum Fund. In April 2000, Durckenmiller explained his losses during the Internet stock market crash by saying: "We thought it was the eighth inning, but it was the ninth."<sup>185</sup>

A more formal study of the behavior of hedge funds during the Internet bubble offers additional support to the presumption that rational speculators chose to ride the bubble. Brunnermeier and Nagle found the proportion of technology stocks in the portfolio of hedge funds during 1998-2000 was significantly higher than their proportion in the market portfolio.<sup>186</sup> At the peak of the bubble it reached 31% while the equivalent proportion in the market portfolio was 21%.<sup>187</sup> Moreover, an investigation of individual stock holdings shows hedge funds reduced their holdings of a stock before its price collapsed.<sup>188</sup> Last, within the technology segment, and only in that segment, hedge funds outperformed standard characteristics-matched benchmarks.<sup>189</sup> Griffin et al. found that institutions held a large fraction of the Nasdaq market capitalization and were also responsible for more trading volume than individuals during the market

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<sup>182</sup>*Id.* at tbl. B-5.

<sup>183</sup>*See* Dhar & Goetzmann, *supra* note 179, at tbl. C-2.

<sup>184</sup>*See supra* Part III.D.3.a.

<sup>185</sup>Joshua Chaffin et al., *Sinking Fortunes*, FIN. TIMES, May 5, 2000, at 24.

<sup>186</sup>Markus K. Brunnermeier & Stefan Nagel, *Hedge Funds and the Technology Bubble*, 59 J. FIN. 2013, 2014 (2004).

<sup>187</sup>*Id.* at 2022.

<sup>188</sup>*Id.* at 2014.

<sup>189</sup>*Id.*

run-up.<sup>190</sup> Moreover, institutions chased daily trends—a standard deviation increase in yesterday's market return was followed by a 0.48 standard deviation increase in today's net institutional buying.<sup>191</sup>

b. *Rational Herding by Money Managers*

The goal of a rational investor may be influenced by factors other than singular profit maximization of the investment portfolio. Obvious reasons include career concerns and other institutional incentives. An empirical study by Chevalier and Ellison on the effect of career concerns shows that the goal of avoiding "termination" based on performance affects the portfolio composition of young fund managers.<sup>192</sup> In particular, consistent with this theory, young managers have an incentive to avoid unsystematic risk and "herd" into popular stocks.

Allen and Gorton illustrate in a simple model how speculative behavior may arise from incentive considerations of portfolio managers.<sup>193</sup> They show that when there is asymmetric information between investors and portfolio managers regarding the quality of the managers, the optimal incentive scheme for the managers is still one that gives them an incentive to generate trades that involve buying securities that are traded above their fundamental value.<sup>194</sup> This optimal incentive scheme is in the form of a call option on the portfolio's incremental return, i.e., it pays the manager a portion of the returns when these are positive.<sup>195</sup> Consequently, while optimal, it provides incentives for managers to acquire securities that have some chance of generating positive returns, even if they know they may lose money for the investors when the bubble crashes.<sup>196</sup>

c. *Ignoring Information About the Issuer in an Information Cascade*

The essence of an information cascade is that private information on the issuer is outweighed by the information on a stock inferred from the trading behavior of others. If the counterfactual for testing reliance is that a plaintiff trader knows some negative information but does not know how

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<sup>190</sup>John M. Griffin et al., *Investor Behavior Over the Rise and Fall of Nasdaq* (Yale ICF Working Paper No. 03-27, 2003).

<sup>191</sup>*Id.* at 3.

<sup>192</sup>Judith Chevalier & Glenn Ellison, *Career Concerns of Mutual Fund Managers*, 114 Q. J. ECON. 389, 391-92 (1999).

<sup>193</sup>Franklin Allen & Gary Gorton, *Churning Bubbles*, 60 REV. ECON. STUD. 813 (1993).

<sup>194</sup>*Id.* at 815.

<sup>195</sup>*Id.*

<sup>196</sup>*Id.*

many others know, she may not act on it when she observes many others purchasing the stock. The fact that others are purchasing based on information unavailable to her could cause the plaintiff to second-guess herself and override her private negative information.

This result does not change if the counterfactual for reliance involves a class of investors who know the omitted information. As long as they are not aware (or informed) of what others know, and in particular they believe that others could have positive information that outweighs the negative omitted information, they may choose to herd and acquire the stock. Consequently, it may well be that a small group of irrational optimistic investors ignites an information cascade that effectively blocks the now almost-public omitted information from having an effect on trading decisions.

#### 4. Lack of Reliance Caused by Cognitive Bias

If rational investors can choose to ride a bubble and not offset a mispricing, consider the compounded problem for efficient markets if plaintiff investors are less than fully rational. We have already discussed the experimental and market-based evidence of investors' overconfidence. Moreover, in the previous section we reviewed theories where overconfidence led to differences in opinions among investors who were rational in other aspects of their decision making and information processing.<sup>197</sup> As a result, these investors were willing to hold long positions in an overpriced stock because they were forecasting that other investors would be more optimistic than they were at some point in the future. Investors acting on this premise would seem to be opposed to the presumption of reliance. While one cannot necessarily prove that an investor is overconfident, both theoretical models and recent empirical papers find it leads to higher than average trading volume and higher than average turnover.<sup>198</sup> Therefore, it may be reasonable to hold individuals who rank high on these measures to higher standards of proving reliance. Naturally, more blunt forms of irrationality, such as momentum trading, should fail the test of reliance. Technical and naïve strategies are likely not to respond directly to information on the issuer but rather to aspects of the

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<sup>197</sup>See *supra* Part IV.B.3.

<sup>198</sup>See Barber & Odean, *supra* note 108 (using gender as a proxy for overconfidence in financial tasks); Markus Glaser & Martin Weber, *Overconfidence and Trading Volume* (Ctr. for Econ. Policy Research Discussion Paper No. 3941, 2003) (linking a direct measure of investor's overconfidence, compiled using a questioner, with an investor's trading history).

price path that, in an inefficient market, might be quite diverged from fundamental value.

The degree of overconfidence in an entire class is likely to be greater in the later stages of a bull market. Traders would not have the benefit of learning because nonrational strategies such as momentum trading or variants of the "greater fool" theory would be earning high returns. This would create higher confidence in trading approaches that ignore information about the issuer. The hypothetical release of allegedly-omitted negative information about the issuer would not cause a rethinking of these strategies until there is a loss associated with the news. This creates a "chicken or the egg" problem, however. As long as investor psychology is ignoring valuable information about the issuer (including rational investor psychology for reasons described above) there may not be enough selling pressure to cause the stock price to drop. Without such a negative outcome there would be no cause for a change in beliefs about the dominant trading strategy and issuer information would continue to be largely irrelevant to most investors.

In conclusion, shifting the burden of proving reliance to plaintiffs may be a plausible outcome even if one is unwilling to go as far as abandoning the efficient market hypothesis. The question of how a defendant can go about proving that any single investor was trading under the belief that the stock was inflated is left mostly unanswered. From the standpoint of shifting the burden of proof, however, this may not be relevant. Whenever the market can be shown to have the elements of a bubble, which very often *is* an answerable question, then the *presumption* of reliance under *Basic* is no longer valid.

### C. *Event Studies of Materiality*

In a fraud-on-the-market case, materiality is the other side of the same coin as reliance. Information that is not material does not affect the stock price or expected returns and so would not cause a reasonable investor to buy or sell a security. In other words, plaintiffs who cannot prove materiality cannot prove transaction causation. Under a fraud-on-the-market theory, transaction causation and reliance are collapsed; in an efficient market it is presumed that an investor would not knowingly buy a security at a price higher than its true value. "Who would knowingly roll the dice in a crooked crap game?"

Consequently, our interest in materiality is not so much whether omitted information is material to the plaintiffs—that subject was covered in the section on reliance—but how it can be detected. As described above, in an efficient market, one can measure the value that some information has

to the average market participant by measuring the change in stock price caused when that information is revealed to the market. Because the stock price is the present value of future cash flows in an efficient market, changes in the expected level of those cash flows will impact the stock price, while news that does not matter to investors' views about cash flows will not impact the stock price. Thus, there is a direct link between what is material to an investor and the way that a stock price responds to a disclosure of information in an efficient market. Unfortunately, that link does not necessarily hold if the market is not efficient.

### 1. Event Studies and an Inefficient Market

One can easily assert that if a market is not efficient then the price of a security can move in any manner at all. Therefore, even material news may not move the price while wholly immaterial news could cause a large change in price. But, this would be too easy an argument to make. Instead, the real question is whether the theories developed in behavioral finance present specific reasons why material news and significant stock price movements should not be considered as mirror images of one another.<sup>199</sup>

Once one severs the link between future cash flows and prices, the next question that arises is whether news about cash flows can be immaterial for the level of the stock price. One should be careful to note that just because other information may affect a stock price, it does not automatically follow that cash flow information will also. If investors are partially adjusting their demands on the basis of information unrelated to the fundamentals, prices may not accurately incorporate the news. In such an instance, however, a properly done event study should be able to test for materiality.<sup>200</sup> If the price impact of the misleading information is

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<sup>199</sup>In the area of stock price anomalies (not the main focus of this article), one of the most obvious arguments comes from the analysis of underreaction and overreaction of stock prices. These studies are direct empirical tests of whether short-term stock price movements are accurate measures of the long-run estimate of the importance of information. If underreaction is a general phenomenon, then news that will ultimately impact the stock's price may sometimes turn out to have an understated impact in the short run, with the implication that some material news will have such an understated impact that the associated price movement is not statistically significant. Therefore, by examining only the short-run impact of the response to certain news, one would erroneously misclassify some material information as immaterial. To the extent that there is short-run overreaction, then the reverse would be true: some news that is generally immaterial would be erroneously classified as material by looking at the excessive short-run price movement. Note, however, that such anomalies have been recorded in the literature over the past twenty years but appear to be infrequently found in shareholder class actions. Consequently, by themselves they will only rarely effect the presumption of reliance.

<sup>200</sup>See MacKinlay, *supra* note 39; Tabak & Dunbar, *supra* note 40.

statistically insignificant when it comes out, then investors are ignoring it at that time. If the price impact is insignificant on the corrective disclosure, then it is immaterial at that time and, in addition, plaintiffs have not shown that losses were caused by the alleged fraud.

## 2. If Price Is Not the Present Value of Future Cash Flows, Can Immaterial Information Affect the Stock Price?

The other half of the story is the possibility that immaterial information causes a sharp decline in the price of an individual stock or an entire sector of securities. The definition of immaterial information in this analysis is that it is already known or, as before, it does not have a statistically significant effect on stock price in an efficient market. When the market is not efficient, however, the normal conditions for interpreting the valuation component of an event study are not present. If investors are not basing their price forecast on future cash flows alone, but instead they are, for example, herding after others or responding to momentum in the price, immaterial information about the issuer of the security may well have a significant effect on the price.

This is illustrated by an event study described in *Contagious Speculation and a Cure for Cancer: A Nonevent that Made Stock Prices Soar*.<sup>201</sup> On May 3, 1998, the Sunday edition of *The New York Times* reported a recent breakthrough in cancer research, and mentioned EntreMed (ENMD), a company with licensing rights to the breakthrough.<sup>202</sup> The stock price reacted immediately and dramatically.<sup>203</sup> From a closing price of \$12 on Friday prior to the news, the market opened at \$85 and closed near \$52 on Monday.<sup>204</sup> It closed above \$30 in the three following weeks.<sup>205</sup> This could have been considered as evidence of efficient markets at work except that there was no new news in the article.<sup>206</sup> *Nature* and various popular newspapers (including *The Times*) reported the potential breakthrough more than five months earlier.<sup>207</sup> The first report, containing the news about the breakthrough, came out on November 27, 1997.<sup>208</sup> The

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<sup>201</sup>Gur Huberman & Tomer Regev, *Contagious Speculation and a Cure for Cancer: A Nonevent that Made Stock Prices Soar*, 56 J. FIN. 387 (2001).

<sup>202</sup>*Id.* at 387.

<sup>203</sup>*Id.*

<sup>204</sup>*Id.*

<sup>205</sup>Huberman & Regev, *supra* note 201, at 387.

<sup>206</sup>*Id.* at 391.

<sup>207</sup>*Id.* at 390.

<sup>208</sup>*Id.*

market responded with an unusually high trading volume and a price increase of 28.4%.<sup>209</sup> The unusually high volume suggests that the news did not go unnoticed.<sup>210</sup> Notwithstanding this, the price reaction was much smaller than the 330% return reaction to the "no-new news."<sup>211</sup> The news and no-new news had an impact on other firms in the Nasdaq Biotechnology Combined Index as well.<sup>212</sup> In particular, the returns of seven stocks in the index exceeded 25% following the article in May on a trading volume that was fifty times the average daily volume.<sup>213</sup> Similarly to the effect on EntreMed, their average return following the earlier report in November was only 4.89% on a trading volume comparable to the average daily trading volume at the time.<sup>214</sup>

### 3. The Materiality Signal in a Bubble

Earlier this article described the endogenous creation of a bubble as a result of a "failure" to coordinate. That is, the bubble persists as long as a sufficient number of people think that a sufficient number of others are likely not to sell the inflated stock at the moment. These beliefs could be rationalized because, while every rational investor knows that a correction is in place and also knows that others will reach the same conclusion, no one knows when the exact moment is that a sufficient number of investors are ready to act. A public announcement, however, can serve as a trigger that "tips" the market. That is, regardless of whether an investor thinks that the announcement delivers any relevant information, as long as she thinks a sufficient number of others will interpret it as such and so decide to exit the market, it is rational for her to do the same. As a result, an otherwise immaterial announcement causes a massive supply of stock and hence a decline in the price. That is, the belief that the announcement is material is self-fulfilling. For example, the disclosure may imply no change in the fundamentals. It, however, may cause a "correction," unrelated to any information about the true value of the stock.<sup>215</sup>

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<sup>209</sup>Huberman & Regev, *supra* note 201, at 390.

<sup>210</sup>*Id.*

<sup>211</sup>*Id.* at 391.

<sup>212</sup>*Id.* at 392.

<sup>213</sup>Huberman & Regev, *supra* note 201, at 392.

<sup>214</sup>*Id.* at 388.

<sup>215</sup>This type of coordination argument is often used among macroeconomists to explain bank runs.