ASSESSING MARKET EFFICIENCY FOR RELIANCE ON THE FRAUD-ON-THE-MARKET DOCTRINE AFTER WAL-MART AND AMGEN

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ABSTRACT

Following the Supreme Court’s 1988 decision in Basic, securities class plaintiffs can invoke the “rebuttable presumption of reliance on public, material misrepresentations regarding securities traded in an efficient market” [the “fraud-on-the-market” doctrine] to prove classwide reliance. Although this requires plaintiffs to prove that the security traded in an informationally efficient market throughout the class period,
Basic did not identify what constituted adequate proof of efficiency for reliance purposes.

Market efficiency cannot be presumed without proof because even large publicly traded stocks do not always trade in efficient markets, as documented in the economic literature that has grown significantly since Basic. For instance, during the recent global financial crisis, lack of liquidity limited arbitrage (the mechanism that renders markets efficient) and led to significant price distortions in many asset markets. Yet, lower courts following Basic have frequently granted class certification based on a mechanical review of some factors that are considered intuitive “proxies” of market efficiency (albeit incorrectly, according to recent studies and our own analysis). Such factors have little probative value and their review does not constitute the rigorous analysis demanded by the Supreme Court.

Instead, to invoke fraud-on-the-market, plaintiffs must first establish that the security traded in a weak-form efficient market (absent which a security cannot, as a logical matter, trade in a “semi-strong form” efficient market, the standard required for reliance purposes) using well-accepted tests. Only then do event study results, which are commonly used to demonstrate “cause and effect” (i.e., prove that the security’s price reacted quickly to news — a hallmark of a semi-strong form efficient market), have any merit. Even then, to claim classwide reliance, plaintiffs must prove such cause-and-effect relationship throughout the class period, not simply on selected disclosure dates identified in the complaint as plaintiffs often do.

These issues have policy implications because, once a class is certified, defendants frequently settle to avoid the magnified costs and risks associated with a trial, and the merits of the case (including the proper application of legal presumptions) are rarely examined at a trial.

Keywords: Securities class actions; fraud-on-the-market; arbitrage limits

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OVERTVIEW

In its seminal decision in *Basic* in 1988, the U.S. Supreme Court permitted plaintiffs to prove classwide reliance by endorsing the “fraud-on-the-market” doctrine, which allows plaintiffs to “invoke a rebuttable presumption of reliance on public, material misrepresentations regarding securities traded in an efficient market.” *Basic* did not clarify what constituted adequate proof of efficiency for reliance purposes. Instead, left to develop their own standards of proof in this regard, lower courts typically rely on a “jumbled” list of factors (the best-known coming from *Cammer v. Bloom*, a district court decision shortly after *Basic*) that are considered intuitive indicators or “proxies” of market efficiency. However, according to a large body of economic evidence documented since *Basic*, even large and actively followed publicly traded securities do not always trade in efficient markets. Tellingly, the 2013 Nobel Prize in Economics was shared by Eugene Fama, the father of market efficiency theory, and Robert Shiller, one of that theory’s leading critics. We believe that continued reliance on ad hoc *Cammer* factors is inadequate to meet the Supreme Court’s requirement that, to obtain class certification, plaintiffs must prove that the security at issue traded in an efficient market throughout the class period based on rigorous analysis.

To see why, we begin in the section entitled “The Link Between the Fraud-on-the-Market Theory (a Judicial Doctrine) and Market Efficiency Hypothesis (an Economic Theory)” by discussing the link between fraud-on-the-market (a judicial doctrine) and market efficiency theory (an economic theory). In the section entitled “Tests of efficiency used in the
In the context of securities class actions, for a plaintiff class to be certified under Rule 23(b)(3) of the Federal Rules of Civil Procedure, a court must find "that the questions of law or fact common to class members predominate over any questions affecting only individual members," which as the Supreme Court noted in its 2011 \textit{Halliburton} decision, "often turns on the element of reliance."\footnote{7} In fact, the Supreme Court has recognized that, in 

\textbf{THE LINK BETWEEN THE FRAUD-ON-THE-MARKET THEORY (A JUDICIAL DOCTRINE) AND MARKET EFFICIENCY HYPOTHESIS (AN ECONOMIC THEORY)}

\textit{Basic and Class Action Law}

In securities class actions, for a plaintiff class to be certified under Rule 23(b)(3) of the Federal Rules of Civil Procedure, a court must find “that the questions of law or fact common to class members predominate over any questions affecting only individual members,” which as the Supreme Court noted in its 2011 \textit{Halliburton} decision, “often turns on the element of reliance.”\footnote{7} In fact, the Supreme Court has recognized that, in
the absence of some method for resolving questions of reliance on a class-wide basis, the inherently individual question of what investors relied on in making a purchase or sale decision would make class action treatment of securities fraud claims impractical and unmanageable.8

In its seminal decision in Basic9 in 1988, the Supreme Court adopted a judicially created presumption to permit plaintiffs to dispense with proving individualized reliance on alleged misrepresentations where they purchased in the open market, but stressed that reliance was nonetheless a crucial element of a securities fraud case, as it provided the causal link between a misrepresentation and harm to the investor:

Reliance provides the requisite causal connection between a defendant’s misrepresentation and a plaintiff's injury ... There is, however, more than one way to demonstrate the causal connection. Indeed, we previously have dispensed with a requirement of positive proof of reliance, where a duty to disclose material information had been breached, concluding that the necessary nexus between the plaintiffs’ injury and the defendant’s wrongful conduct had been established.

Requiring a plaintiff to show a speculative state of facts, i.e., how he would have acted if omitted material information had been disclosed ... or if the misrepresentation had not been made ..., would place an unnecessarily unrealistic evidentiary burden on the Rule 10b-5 plaintiff who has traded on an impersonal market.10

Driven by this practical concern, the Court permitted plaintiffs to prove classwide reliance by endorsing the “fraud-on-the-market” doctrine, which allows plaintiffs to “invoke a rebuttable presumption of reliance on public, material misrepresentations regarding securities traded in an efficient market.”11 As Justice Thomas noted in his dissenting opinion in the Court’s 2013 Amgen decision, fraud-on-the-market is “a judicially invented doctrine based on an economic theory adopted to ease the burden on plaintiffs bringing claims under an implied cause of action.”12 The Court adopted this economic theory as a legal presumption on the basis of (1) the legislative history of the Securities Exchange Act of 1934 showing a Congressional “premise” that “competing judgments of buyers and sellers as to the fair price of a security brings [sic] about a situation where the market price reflects as nearly as possible a just price,” and (2) its assessment of “common sense and probability” derived from “[r]ecent empirical studies [through the use of sophisticated statistical analysis and the application of economic theory that] have tended to confirm Congress’ premise that the market price of shares traded on well-developed markets reflects all publicly available information, and, hence, any material misrepresentations.”13 Thus, the Court concluded that, “[b]ecause most publicly available
information is reflected in market price, an investor’s reliance on any public material misrepresentations, therefore, may be presumed for purposes of a Rule 10b-5 action.”

After *Basic*, courts have viewed the link between the market efficiency hypothesis and fraud-on-the-market theory as a “syllogism: (a) an investor buys or sells stock in reliance on the integrity of the market price; (b) publicly available information, including material misrepresentations, is reflected in the market price; and therefore, (c) the investor buys or sells stock in reliance on material misrepresentations. This syllogism breaks down, of course, when a market lacks efficiency, and the market does not necessarily reflect the alleged material misrepresentation.”

The Court more recently, in *Halliburton*, distilled as “*Basic*’s fundamental premise — that an investor presumptively relies on a misrepresentation so long as it was reflected in the market price at the time of his transaction.”

The Court in *Amgen* further anchored the presumption in the view of market reality that market efficiency theory portrays:

This presumption springs from the very concept of market efficiency. If a market is generally efficient in incorporating publicly available information into a security’s market price, it is reasonable to presume that a particular public, material misrepresentation will be reflected in the security’s price. Furthermore, it is reasonable to presume that most investors — knowing that they have little hope of outperforming the market in the long run based solely on their analysis of publicly available information — will rely on the security’s market price as an unbiased assessment of the security’s value in light of all public information.

The validity of this premise therefore depends on plaintiffs using economically sound evidence to show that the market in question was actually acting the way the theory posits. Because the presumption is not dictated by statute but is adopted as a method of proving actual causation through economics, that places an obligation on courts to consider the advances in economic understanding of markets in the quarter century since *Basic*.

The efficient market hypothesis, which was widely accepted by financial economists at the time of *Basic*, hypothesizes that a security’s price quickly and correctly impounds material new public information. If a security is temporarily mispriced (given available information) then such mispricing is quickly corrected in an efficient market through “arbitrage.”

Lo (2008) describes this process as trading by “an army of investors [who] pounce on even the smallest informational advantages at their disposal [to earn a profit], and in doing so they incorporate their information into market prices and quickly eliminate the profit opportunities that first motivated their trades. If this occurs instantaneously, which it must in an idealized
world of ‘frictionless’ markets and costless trading, then prices must always fully reflect all available information.”21 At its most basic level, for instance, two securities with identical cash flows must trade at the same price in an efficient market (referred to as “Law of One Price”). In short, it is the looming presence of arbitrage trading that keeps a market efficient. Given such arbitrage activity, no obvious arbitrage opportunity should persist in an efficient market. If it does (i.e., if the “no-arbitrage condition” is violated) then the market is considered inefficient. The Supreme Court, in Amgen, explained:

The fraud-on-the-market theory rests on the premise that certain well developed markets are efficient processors of public information … Few investors in such markets, if any, can consistently achieve above-market returns by trading based on publicly available information alone, for if such above-market returns were readily attainable, it would mean that market prices were not efficiently incorporating the full supply of public information. See R. Brealey, S. Myers, & F. Allen, Principles of Corporate Finance 330 (10th ed. 2011) (“[I]n an efficient market, there is no way for most investors to achieve consistently superior rates of return.”).22

Importantly, to invoke Basic’s rebuttable presumption of reliance in the context of a class action, plaintiffs must prove at the class certification stage that the security at issue traded in an “efficient market” during the alleged class period, as the Supreme Court has reiterated in two recent decisions (Halliburton and Amgen). For instance, in Halliburton, the Court noted that “it is undisputed that securities fraud plaintiffs must prove certain things in order to invoke Basic’s rebuttable presumption of reliance … . [F]or example, that plaintiffs must demonstrate that the alleged misrepresentations were publicly known (else how would the market take them into account?), that the stock traded in an efficient market.”23 In Amgen, the Court, citing Wal-Mart, reiterated: ‘‘[P]laintiffs seeking 23(b)(3) certification must prove that their shares were traded on an efficient market,’ an element of the fraud-on-the-market theory (emphasis added).”24 The Amgen opinion noted that “without that proof, there is no justification for certifying a class.”25

Moreover, the courts have increasingly emphasized that such proof cannot be perfunctory. As the Supreme Court held in Wal-Mart, class certification is proper only if the “trial court is satisfied, after a rigorous analysis, that the prerequisites of Rule 23(a) have been satisfied” and that “Rule 23 does not set forth a mere pleading standard. A party seeking class certification must affirmatively demonstrate his compliance with the Rule — that is, he must be prepared to prove that there are in fact sufficiently numerous parties, common questions of law or fact, etc.”26 The reason for this is that
the defendant’s potential liability to a class “must be of such a nature that it is capable of classwide resolution — which means that determination of its truth or falsity will resolve an issue that is central to the validity of each one of the claims in one stroke.”

In addition to liability, the Supreme Court in its 2013 *Comcast* decision held that damages must be capable of determination on a common basis according to a common damages model that flows from the determination of liability; otherwise, “[q]uestions of individual damage calculations will inevitably overwhelm questions common to the class.”

Consistent with *Basic’s* focus on practical market realities, *Wal-Mart* and *Comcast* emphasized that a class action is designed for the situation where a jury can make a final, up-or-down decision as to the class that is actually true as to all class members, rather than use a sampling of cases to conduct what the Court in *Wal-Mart* described as “Trial by Formula” while ignoring defenses that the defendant would have been entitled to raise in particular cases.

In *Comcast*, the Court noted that a damages model in an antitrust case against a cable television company would not show that the case was a proper class action unless it “plausibly showed that the extent of [the antitrust violation] would have been the same in all counties” where the company did business. The Court in *Amgen* stressed that the question of materiality, by contrast, could properly be determined on a classwide basis because “[t]he alleged misrepresentations and omissions, whether material or immaterial, would be so equally for all investors composing the class … a failure of proof on the issue of materiality would end the case, given that materiality is an essential element of the class members’ securities-fraud claims. As to materiality, therefore, the class is entirely cohesive: It will prevail or fail in unison.”

*Amgen* contrasted this to the situation where issues individual to particular investors were raised by the investor buying at a time when the price was not affected by the misrepresentation:

A security’s market price cannot be affected by a misrepresentation not yet made, and in an efficient market, a misrepresentation’s impact on market price is quickly nullified once the truth comes to light. Thus, a plaintiff whose relevant transactions were not executed between the time the misrepresentation was made and the time the truth was revealed cannot be said to have indirectly relied on the misrepresentation through its reliance on the integrity of the market price. Such a plaintiff’s claims, therefore, would not be “typical” of the claims of investors who did trade during the window between misrepresentation and truth revelation.

The theory must assume that if the market is efficient, each purchaser during the class period will be affected in the same way and in the same
amount, just as the Court required for antitrust damages in Comcast — that “price inflation” enters the price of the stock as soon as the misrepresentation enters the market (and exits the price as soon as it is corrected).\textsuperscript{33}

If that common price impact is not present, then the presumption is a false guide: not every purchaser of stock was affected in the same way, and the class will include some members who did not actually buy stock at a time when misrepresentations were “reflected in the security’s price.”\textsuperscript{34}

Thus, the Basic presumption provides the cohesion and “unison” required by Wal-Mart, Comcast, and Amgen only if the underlying economic theory can reliably show a common price impact on all purchasers over every day of the class period, such that price inflation can reasonably be presumed simply from a purchase during the period (and damages can later be computed mathematically from a showing of when the price inflation was dissipated by a corrective disclosure). The longer the class period and the larger the number of misrepresentations alleged, the greater the importance of assuring that the market remained consistently efficient at all times to avoid inclusion in the class of investors who purchased at prices unaffected by misrepresentations.\textsuperscript{35}

Finally, the test for market efficiency, to be useful to courts, must be capable of testing by evidence in the adversary process and not merely the subject of speculation or the \textit{ipse dixit} of the expert. This requirement is more important given that the Supreme Court has held that neither materiality nor loss causation is a required element of proof at the class certification stage. The Supreme Court has long warned, especially in the context of the judicially created Rule 10b-5 cause of action, against creating liabilities that depend on proof of speculative facts that cannot be tested by objective, extrinsic evidence.\textsuperscript{36} Indeed, that was one of the justifications for the Basic presumption itself. It is imperative that courts, in basing class certification on a theory of market efficiency, actually put that theory’s applicability to a test that can be evaluated on some objective, scientific basis and not just presumed from the existence of a loss on the plaintiff’s investment.

There is substantial basis in the economic literature for finding markets to be informationally efficient, but not for simply presuming them efficient without examination. As discussed later, market efficiency theory cannot simply be assumed to be always true given the large body of finance literature has emerged since Basic demonstrating that the theory does not always hold. Instead, objective and rigorous analysis of evidence supporting the plaintiffs’ claims that the security at issue traded in an efficient market throughout the alleged class period is imperative at the class certification stage, as we discuss in detail in this article.
Efficient Capital Markets

In a market without frictions, an arbitrageur can earn an immediate risk-free profit with no up-front capital by simultaneously buying and selling identical securities at different prices. Such arbitrage trading in mispriced securities leads prices to correct quickly and restores market efficiency. In theory, as Shleifer and Vishny (1997) note, such arbitrage “requires no capital and entails no risk” and thus can be readily implemented. But in practice, market frictions may limit arbitrage, the mechanism by which markets are rendered efficient and the Law of One Price is enforced. Indeed, since Basic was decided, a very large body of economic literature has established that while actively traded and widely followed securities that trade on well-developed public markets are generally informationally efficient, violations of market efficiency are far more numerous and systematic than was previously thought, given limits to arbitrage. As a result, security prices can deviate from what would be observed in efficient markets, sometimes over extended periods of time. What is more, such instances of market inefficiencies (or “anomalies”) are observed even for stocks issued by some of the largest publicly traded companies that are extensively followed by analysts and widely traded by investors. Tellingly, the 2013 Nobel Prize in Economics was shared by Eugene Fama, the father of market efficiency theory and Robert Shiller, one of that theory’s principal critics.

The large body of research that has developed since Basic to examine this economic issue has identified several real-world phenomena that may limit arbitrage even when investors are assumed to act rationally. We discuss a few well-accepted limits to arbitrage here. First, if gathering information is costly, then an arbitrageur would be willing to invest in gathering information only if he could profit from it. But if the security’s price is always efficient then such arbitrage profits are impossible. Knowing this, no arbitrageur would then be willing to invest in gathering information, and then, paradoxically, the security’s price could not be informationally efficient. This paradox, first articulated by Nobel laureate Joseph Stiglitz and Sanford Grossman, implies that given information-gathering costs, security prices cannot fully reflect all available information at all times. Instead, a certain degree of inefficiency is necessary to incentivize arbitrageurs to invest in gathering more information about a security. Thus, as Fama (1991, p. 1575) noted, when information-gathering and trading costs exist, “[a] weaker and economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the
marginal benefits of acting on information (the profits to be made) do not exceed the marginal costs.”

Second, the risk that mispriced securities’ prices may diverge further from their informationally correct values before correcting may limit the supply of capital necessary for arbitrage. As Shleifer and Vishny (1997) noted, arbitrage is a specialized activity that is generally conducted by profession fund managers who use other people’s capital. Such investors may become nervous and demand their money back if the securities purchased by the fund manager on behalf of these outside investors decline further in value (which can occur if mispriced securities’ prices temporarily diverge further from their correct values). To honor such redemption requests by investors, the fund manager may be forced to sell the mispriced securities prematurely (before the mispricing is corrected) and incur a loss. Anticipating this problem, arbitrageurs (fund managers) may not undertake certain arbitrage trades, and security mispricing may persist. Studies have documented that even under “normal” market conditions, stocks of certain large publicly traded companies have violated the Law of One Price (the most basic condition for a market to be deemed efficient). Notably, these violations persisted for extended periods even though they were discussed extensively in the popular press at the time. These cases are considered glaring instances of inefficiency in the academic literature.

The lack of capital to conduct arbitrage was especially evident during the unprecedented global financial crisis of 2007–2009. The “depletion of dealer capital was so severe that, among other effects, large distortions in arbitrage-based pricing relationships appeared,” as Stanford economist, Darrell Duffie noted in his presidential address to the American Finance Association in 2010 [See Duffie (2010)]. As we will discuss later, such a liquidity crunch severely limited arbitrage and resulted in Law of One Price violations in several markets.

In short, given this large body of academic evidence, economists today do not consider market efficiency a foregone conclusion in every situation, as might have been the case decades ago. Instead, the academic debate about the validity of the efficient markets hypothesis in various contexts based on decades of rigorous, peer-reviewed research continues to this day. An economist approaching a particular market would examine the efficiency of the market for the particular security at issue at the time in question, rather than assuming it. In contrast, such rigorous analysis is often absent in the “proof” that courts have routinely been provided at class certification stage.
Basic did not clarify what constituted adequate proof of efficiency for reliance purposes.\textsuperscript{45} Instead, left to develop their own standards of proof in this regard, lower courts typically rely on a “jumbled”\textsuperscript{46} list of factors (the best-known five coming from \textit{Cammer v. Bloom},\textsuperscript{47} from a district court decision shortly after Basic) as such factors are considered intuitive indicators or “proxies”\textsuperscript{48} of market efficiency. In addition to the five factors originally listed in \textit{Cammer}, three more factors have been generally considered. This augmented list of eight factors are as follows:

1. the average weekly trading volume expressed as a percentage of total outstanding shares;
2. the number of securities analysts following and reporting on the stock;
3. the extent to which market makers and arbitrageurs trade in the stock;
4. the company’s eligibility to file SEC registration Form S-3 (as opposed to Form S-1 or S-2);
5. the existence of empirical facts “showing a cause and effect relationship between unexpected corporate events or financial releases and an immediate response in the stock price;”
6. the company’s market capitalization;
7. the bid-ask spread for stock sales; and
8. float, the stock’s trading volume without counting insider-owned stock.\textsuperscript{49}

Courts have varied in their application of these factors, and some courts have tended to gloss over them when a stock trades on a well-known market such as the New York Stock Exchange (NYSE) or NASDAQ.\textsuperscript{50} Others, such as the Second Circuit, have emphasized that “factor five,” the rapid share price reaction to unexpected corporate news, is the primary focus of the market efficiency inquiry:

Evidence that unexpected corporate events or financial releases cause an immediate response in the price of a security has been considered the most important \textit{Cammer} factor … and the essence of an efficient market and the foundation for the fraud-on-the-market theory. Without the demonstration of such a causal relationship, it is difficult to presume that the market will integrate the release of material information about a security into its price. An event study that correlates the disclosures of unanticipated, material information about a security with corresponding fluctuations in price has been considered \textit{prima facie} evidence of the existence of such a causal relationship.\textsuperscript{51}

However, as several economic studies have recognized, many of the \textit{Cammer} factors do not prove that a security traded in an efficient market, as they fail to distinguish between securities that trade in efficient markets from those that do not.\textsuperscript{52} According to some studies, stocks which did not trade in informational efficient markets according to more rigorous and direct tests of efficiency nevertheless satisfied the \textit{Cammer} factors.\textsuperscript{53} Below, we also demonstrate that the \textit{Cammer} factors were “satisfied” by several stocks that violated the Law of One Price — the most basic market
efficiency condition — for extended periods according to studies published in leading academic journals.

Even though several of the Cammer factors are only secondarily related to market efficiency, and others may fail consistently to detect market inefficiency, a plaintiff’s claim of reliance based on such factors “is not disputed in the vast majority of shareholder class actions,” and, until recently, “has not been rebutted in any case involving actively traded securities.”

As a result, classes have been frequently certified which generally forces defendants to settle, given the magnified costs and risks associated with a trial. Not surprisingly, billions of dollars have been paid out in settlements in 10b-5 lawsuits “as a result of Basic” and only “8 percent of all federal class action securities fraud claims ever result in a ruling on a motion for summary judgment.” The merits of the plaintiffs’ claims, which are assessed only at the trial stage, are thus made largely irrelevant in many cases. Given the rigor required by Wal-Mart, this is not an acceptable result in cases where a closer examination would have revealed that the market was not actually efficient.

Several justices’ opinions in the Supreme Court’s February 2013 Amgen decision echo the view that the policy consequences demand a closer look at the theory under which such classes are certified. The Court was not asked to revisit Basic’s fraud-on-the-market presumption or market efficiency in Amgen, as the defendant had conceded that the market for its stock was efficient. Nevertheless, Justice Scalia opined that, by eliminating one predicate for applying the theory (materiality), the Amgen majority opinion “does not merely accept what some consider the regrettable consequences of the four-Justice opinion in Basic; it expands those consequences from the arguably regrettable to the unquestionably disastrous.” Justice Thomas called the continued reliance on the fraud-on-the-market doctrine “questionable.” He noted that the concerns about the fraud-on-the-market doctrine which Justice White had expressed in his dissenting opinion in Basic — that “[c]onfusion and contradiction in court rulings are inevitable when traditional legal analysis is replaced with economic theorization by the federal courts” and that the Court is “not well-equipped to embrace novel constructions of a statute based on contemporary microeconomic theory” — “remain valid today.” Even the majority opinion in Amgen took note of arguments presented in the briefs that “modern economic research [tends] to show that market efficiency is not a binary, yes or no question,” and in his concurring opinion, Justice Alito noted that “more recent evidence suggests that the presumption may rest on a faulty economic premise. … In light of this development, reconsideration of the Basic presumption may be appropriate.”
TESTS OF EFFICIENCY USED IN THE ECONOMICS LITERATURE

Fraud-on-the-market theory was based on some influential academic studies of market efficiency published in the 1960s and 1970s. Since then, many implications of the Efficient Market Hypothesis (“EMH”) have been empirically examined for a wide range of financial securities and even other assets, such as real estate. In this vast body of literature in financial economics, certain types of empirical tests have become well-accepted and standard. We begin by reviewing how degrees of market efficiency are defined in the financial economics literature and review the standard empirical tests of efficiency commonly used in that literature.

In an efficient market, a security’s price fully reflects all available information. Hence, in his seminal article on the subject, Fama (1970) classified empirical tests of market efficiency into three “forms” (weak, semi-strong, and strong) based on the particular subset of available information considered.

Weak-form efficiency tests examine if a security’s current price fully reflects its historical prices (as well as the prices of other assets). As one court has observed, “the weak form, which asserts simply that the current share price in an efficient market reflects all information about past share prices. If the weak form of the hypothesis accurately describes a market, it is impossible to predict future prices using only past prices.” “[T]he weak form … posits that all previous stock prices, which are necessarily a subset of all public information, are already incorporated into current stock prices.” Such tests include examining whether prices are “serially correlated” – e.g., whether they follow a predictable trend based on one or more prior day’s movement – or instead follow a “random walk.” A momentum-based strategy such as “buy-high/sell-low” which is based on stale information about historical prices should not outperform a simple “buy-and-hold” strategy in an efficiently functioning market after accounting for transaction costs.

Semi-strong form efficiency tests if a security’s current price fully reflects a larger set of information, namely all public information (not only historical prices). It is generally accepted by the courts that the fraud-on-the-market theory is based on the semi-strong form of market efficiency. It follows that, if a stock’s price does not fully impound information related to historical prices (i.e., does not trade in a market that is even weak-form efficient), then it cannot be said to trade in a semi-strong form efficient
market. Therefore, tests of semi-strong form efficiency such as event studies used to establish cause and effect — the most important Cammer factor — are relevant only if it is first confirmed that the security at issue trades in a weak-form efficient market.

In theory, in a strong form efficient market, a security’s price fully reflects not just historical price data or all publicly available information, but all possible information, public and private, including information available to insiders. Financial economists believe that markets are not strong form efficient; the concept of strong form of market efficiency thus is simply a theoretical benchmark.

**Weak-Form Efficiency Tests**

The central feature of an informationally efficient market is succinctly summarized in the title of Nobel Laureate Paul Samuelson’s seminal article published in 1965: “Proof that Properly Anticipated Prices Fluctuate Randomly.” In other words, for a stock to trade in an informationally efficient market (i.e., a market in which the stock’s price fully incorporates available information), it must be impossible to forecast future price changes from observing prior price changes. Therefore, tests of the predictability of stock returns are commonly used to preliminarily assess market efficiency.

A common measure of such returns predictability is “serial correlation,” which measures mathematically the “correlation between the current return on a security and the return on the same security over a later period.” As Ross et al. (2002), a well-known basic finance text notes:

A positive coefficient of serial correlation for a particular stock indicates a tendency toward continuation. That is, a higher-than-average return today is likely to be followed by higher-than-average returns in the future. Similarly, a lower-than-average return today is likely to be followed by lower-than-average returns in the future. A negative coefficient of serial correlation for a particular stock indicates a tendency toward reversal. A higher-than-average return today is likely to be followed by lower-than-average returns in the future. Similarly, a lower-than-average return today is likely to be followed by higher-than-average returns in the future. Both significantly positive and significantly negative serial-correlation coefficients are indications of market inefficiencies; in either case, returns today can be used to predict future returns.

Thus, contrary to some recent commentary, statistically significant serial correlation in publicly traded stocks is rare, and according to
research by Nobel Laureate Clive Granger, if serial correlation in a stock’s returns is found to be “large enough to cover the size of transaction costs,” the finding “invalidate[s]” the conclusion that the stock trades in an efficient market.78 Thus, serial correlation tests, which date back to studies in the 1960s by Cootner (1962) and Fama (1965, 1970), continue to be used in current research.

For instance, a recent study by Erenburg et al. (2011) used serial correlation and other common tests of weak-form efficiency developed in the finance literature (runs tests and tests of profitable momentum strategies) to identify stocks at issue in federal class actions filed in 1996 and 1997 that did not trade in weak-form efficient markets according to such empirical tests. It next examined if five indicators of efficiency commonly considered by the courts could also detect such weak-form inefficiency and concluded that the factors courts commonly considered exhibited “little relation to weak-form market efficiency.”79

Specifically, it found the “blanket presumption of market efficiency for NYSE-listed firms or the Cammer court’s presumption of greater market efficiency for NYSE-listed firms relative to NASDAQ” unsupported because both groups displayed “evidence of weak-form inefficiency” such as serial correlation to a degree that could not be reasonably attributed to chance alone.80 The study also found the “legal presumption” that stocks with coverage by more analysts will be more efficiently priced was “backward” because analyst following was related to one-day serial correlation and stocks followed by more analysts were candidates for profitable one-day momentum strategies.81 The study also concluded that trading volume (turnover) was not indicative of efficiency, contrary to the courts’ intuition. Instead, “inefficient pricing (or “slow price adjustment”) induces more trading.”82 In a similar vein, Erenburg et al. (2011) also found that high-market-cap firms [with market capitalization of at least $1 billion] have more positive serial correlation relative to other firms in their sample, which again contradicts the court’s intuition.83 Finally, Erenburg et al. (2011) found that wide bid-ask spreads, which is considered an indicator of inefficiency according to the Krogman court, also impeded profitable momentum strategies (which exist if the market is weak-form inefficient). Hence, again counter to the court’s opinion, the evidence “indicates that profitable momentum trading is more likely for firms with narrower spreads.”84

Significant serial correlation is indicative of weak-form inefficiency, but it is not the only test. Another way of measuring weak-form inefficiency is through the use of “trading rules” — tests to see if a profit could have been earned simply by buying and selling the stock based on its observed price
movement in order to capitalize on momentum. Fama (1970) noted that is it “difficult to judge what degree of serial correlation would imply the existence of trading rules with substantial expected profits,” so he suggests that “for many reasons it is desirable to directly test the profitability of various trading rules.” While a variety of filter rules can be considered, a simple one is the “y-filter” based trading rule, which examines if a momentum strategy, devised without the benefit of hindsight, earns greater profits than a buy-and-hold strategy. In a weak-form efficient market, such excess profits should be impossible, net of transaction costs. If net of reasonable cost assumptions, y-filter rules indicate profits in excess of the buy-and-hold benchmark then the evidence suggests that the security at issue did not trade in even a weak-form inefficient market over the relevant period.

The scope of weak-form efficiency tests may be expanded to include “tests for return predictability,” e.g., “forecasting returns with variables like dividend yields and interest rates.” Hence, in the spirit of Fama (1991), one may examine (using regression analysis and daily or intra-day data if available) if the security’s returns are statistically significantly related to lagged returns of other securities (in addition to serial correlation tests) to assess weak-form efficiency. If a stock’s future price change can be forecast in a statistically significant manner based on past changes in the price of a related security (such as preferred stocks or bonds issued by the same issuer, or the stocks of other companies in the same industry) then such predictable price trends based on information that was already known to investors would indicate that the stock at issue did not trade in a weak-form efficient market. Recent academic research has shown that not all publicly traded stocks always trade in a market that is even weak-form efficient. In fact, “momentum” (the tendency for rising asset prices to rise further and falling prices to keep falling) is a pervasive anomaly that has been repeatedly documented and is considered by many to be an indicator of market (weak-form) inefficiency.

**Semi-Strong Form Efficiency Tests**

Courts have generally concluded that to invoke the fraud-on-the-market doctrine plaintiffs must prove that the security at issue traded in a semi-strong form efficient market in which the stock price quickly impounds all publicly available information (i.e. is informationally efficient). Semi-strong form efficiency is commonly assessed by examining if a security’s price
quickly and correctly impounds new information (the “cause and effect” Camper factor) using a statistical technique known as “event study.”

The mechanics of an event study are straightforward. The study has the following steps: (1) The event window (day or days) on which the market received unexpected news is identified. (2) The stock’s return or price change over the event window is calculated. (3) The stock’s “residual” return (also referred to at times as the “market-adjusted” or “abnormal” return) over the event window is calculated. The residual return is typically estimated by calculating the “predicted” return “using a [regression] model that takes into account market and industry effects on stock price returns … [and subtracting] the predicted return from the actual return.” (4) The residual return fluctuates daily even in the absence of any news. Hence, a statistical measure referred to as the “t-statistic” is then commonly used to determine if the residual return on a particular day was abnormally large (or significantly different from zero), given its past fluctuations. If a stock’s abnormal return is statistically insignificant (or not distinguishable from zero with a high degree of certitude), then the event study result does not support the conclusion that the stock price reacted to the identified news. The converse, however, is not necessarily true. A statistically significant price reaction on any day (even following some contemporaneous news release) does not necessarily prove that such news caused the observed price reaction, because correlation alone is not proof of causation. To draw an economic conclusion regarding “cause and effect,” further analysis is critical for several reasons.

First, the mechanical steps of an event study can be conducted for any day and the results of such a mechanical calculation alone do not explain what caused the observed price reaction. Although an event study can be conducted for any security, the study’s results (which are used to assess semi-strong for efficiency) have little probative value unless it is first established that the security at issue traded in a weak-form efficient market. If a security does not trade in even a weak-form efficient market, then its price change could in part be attributable to a delayed reaction to stale information (including information about its past prices) or momentum rather than any new information released that day. The presence of such an alternative explanation for the price movement makes it unreasonable to reject the “null hypothesis” of no cause and effect solely on the basis of correlation between the event and the price movement; a study simply cannot conclude what caused the movement with confidence. Thus, the empirical finding that the security’s residual return following a news release is statistically significant does not prove that observed price reaction was a quick and
correct reaction to such news. Without such proof, a statistically significant price movement does not demonstrate cause and effect, the “most important” Cammer factor related to efficiency.94

Second, it is important to recognize that the first step of an event study (identifying the event date when unexpected news first became public) is critical. Instead of arbitrarily focusing on some selected dates, or certain dates identified in the complaint, a careful review of prior mix of information available in the market is necessary. Otherwise, it is impossible to ascertain if the identified event was unexpected new information (“news”) or simply stale information. If a security trades in an efficient market, then its price should not react to stale information because such information would have been impounded into the stock price soon after it was first released.95 Therefore, a statistically significant abnormal price reaction attributed to such information would not prove cause and effect. To the contrary, such a finding would support the opposite conclusion, i.e., that the security did not trade in an efficient market.

Third, a proper event study for purposes of determining market efficiency over a class period must look for consistent demonstration of market efficiency, not just occasional price movements on days with news. The results of an event study based on a small sample of dates when the security price was already known to have declined sharply are not probative. For instance, to prove the cause-and-effect relationship, some economic reports focus on only a handful of dates out of the alleged class period which are typically those identified in the complaint when the stock price was known to decrease significantly. Some have argued that such a limited enquiry (rather than proving that the security at issues traded in an efficient market throughout the class period) is sufficient to prove reliance for class certification purposes.96 We believe such a claim does not constitute the “rigorous analysis” demanded by Wal-Mart for certification purposes.

One reason why is hindsight bias. Some of the news releases may be identified as material misrepresentation or curative disclosure dates in the complaint.97 When a security’s observed daily return is large, its residual return is typically also large and statistically significant.98 Thus, confirming that the stock’s price declined “significantly” on a large price-drop date amounts to merely repeating the complaint’s allegations, as such a date was likely identified as at least a partial curative disclosure in the complaint because the stock price was known to have dropped sharply that day. Statistical significance on a particular date, a technical finding, does not by itself prove that a consistent cause-and-effect relationship existed throughout the relevant class period.99
A second reason is that episodic events are not proof of a consistent cause-and-effect relationship. A limited showing of a relationship between news and price movements on a handful of dates does not demonstrate that the stock traded in an informationally efficient market throughout the alleged class period. From an economic perspective, a rigorous analysis of the security’s price reaction over time is necessary to prove reliance. In *PolyMedica II*, for example, the plaintiff’s expert had found that the stock price reacted significantly to news on 5 (or 3.13%) of 160 trading days in the contested period in that case. However, the Court opined that a “mere listing of five days on which news was released and which exhibited large price fluctuations proves nothing.”

Ferrillo et al. (2004) also reason that, to establish that the security at issue traded in an informationally efficient market, it is not adequate to demonstrate that its price reacted statistically significantly on a handful of news dates. Instead they argue that, to prove efficiency for reliance purposes, plaintiffs must demonstrate that the security’s price reacted statistically significantly more often on days with news (“news dates”) compared to days without news. However, the power of Ferrillo et al.’s test depends critically on how such news dates are identified. If “news dates” are indeed those dates when the market learnt material new information then the security’s price should reacted significantly to “most new, material news” as the court noted in *Freddie Mac*. If, instead, news dates are picked mechanically by simply identifying all dates when the company was “mentioned” in the press as Ferrillo et al. (2004) suggest, such purported “news” may in fact be stale information or immaterial. Even in an efficient market one would not expect to see a significant price reaction on such days. Notably, large companies are mentioned in the press almost daily. Hence almost all days in any sample period could be identified as news dates in such cases, which would limit the applicability of the Ferrillo et al. test. Given these limitations, in *Freddie Mac*, the Court found the plaintiff expert’s use of Ferrillo et al.’s test unreliable. Moreover, simply showing that the market reacted *more often* to news than to non-news does not, logically, support presuming that it *always* reacted to news of the type contained in the alleged misrepresentations — the very presumption that is the entire purpose of using fraud-on-the-market as a basis for class certification.

For purposes of litigation, a focus on price reactions following a few major negative news events affecting the company does not prove that the security traded in a market that was *consistently* efficient throughout the class period, as plaintiffs must in order to claim reliance on statements that
may not have been as dramatically newsworthy. The corrective event at the end of a class period in litigation is often a drastic event such as a bankruptcy, receivership or major restatement of earnings. A security’s price will typically show some reaction to such a drastic event. However, such a price reaction on a single date (or even a handful of selected disclosure dates) does not prove that the security traded in market that was sufficiently efficient to incorporate the effect of all prior statements at issue throughout the relevant class period.

It is not infrequent in securities class actions that there is no statistically significant price reaction on the dates of the alleged misrepresentations. The plaintiffs in such cases often argue the speculative proposition that the misstatement merely confirmed expectations and should not have been expected to move the market price — and that the amount of price inflation should be inferred from the subsequent stock drop.106 For instance, Langevoort (2009) argues, “This is particularly apt when what plaintiffs allege is an omission rather than affirmative lie: the omission will not necessarily lead to an identifiable market move — rather, plaintiffs’ claim is that the market would have adjusted had the truth been told.”

The problem with such a theory is that it is not testable. It is doubly problematic in such cases, where price impact is inferred from a later price decline, to also use that decline as proof of market efficiency. The better course is to require a rigorous showing by other evidence that the price actually did react consistently to unexpected events before the stock drop.

In other cases, plaintiffs have sought to show efficiency based on proof that the market reacted on some percentage of dates, but not others — a conclusion that, applied to a class, would suggest that misstatements could be presumed to have caused harm to all class members when the actual empirical evidence suggests that only a much lower percentage were affected. This is an unacceptable basis for certifying a class and awarding damages, as the Supreme Court held in Comcast.107 After Comcast, a court would not certify an antitrust case where 40% of the class suffered no injury; neither should it certify a securities class where an event study shows that the market failed to react to new, material information 30% or 40% of the time, or where an event study simply failed to examine most of the days in the class period.

For example, in Freddie Mac, the plaintiffs’ expert had set aside 136 of the 193 trading days in the alleged class period for the security at issue (Freddie Mac’s Series Z preferred stock) and reported that, over the remaining segment of the class period, the security’s abnormal return was statistically significant on 28% of the news days he had considered. The
Court found this proof inadequate to establish efficiency for reliance purposes, noting that “[a] plaintiff must show that the market price responds to most new, material news.”\(^{108}\) Citing Bajaj (one of this article’s authors who had testified as an expert for the defendants\(^{109}\)), the Court noted that “an economist may conclude that a market is efficient if it reacts to news 80 to 90\% of the time, depending on the number of news dates at issue.”\(^{110}\)

In *China Automotive Systems*, the plaintiff’s expert found that the stock price reacted significantly to news on 7 out of 16 identified dates but in the wrong direction on another day. The Court opined that “[e]ven assuming that the methodology was proper, showing that only seven out of sixteen days resulted in a market reaction is an insufficient foundation upon which to pronounce market efficiency.”\(^{111}\)

To confirm from an economic perspective that investors could have relied on the integrity of the security’s price throughout the alleged class period — and to provide an economic basis for a legal presumption that all investors were equally affected at all times — it is necessary to conduct a comprehensive analysis of all news released during that entire period and confirm using well-accepted scientific tests that the security’s price consistently reacted quickly and correctly to all such news releases.

*Law of One Price Tests*

The Law of One Price is a central tenet in financial economics and a fundamental criterion for an efficient market. Hence, tests for Law of One Price violations constitute a basic and direct test of efficiency.\(^{112}\) For example, put-call parity tests are commonly used to tests for violations of the Law of One Price. In this test, a portfolio of a call and a put option on the stock and a risk-free bond is constructed to have the same cash flow as the stock by design. The portfolio and the stock are therefore, in effect, identical securities that should always trade at identical prices in an efficient market. This fundamental relationship between the value of the portfolio and the stock is known as put-call parity and is described in most standard finance texts.\(^{113}\) As contemporaneous (and past) prices of the options, bond and stock are publicly known, violations of this parity relationship that are sufficiently large to yield arbitrage profits net of transaction costs such as “bid-ask spreads” and commissions suggest that the security at issue does not trade in an informationally efficient market.

Such direct tests of efficiency are more probative in distinguishing between efficient and inefficient securities markets\(^{114}\) whereas indirect tests
using ad hoc proxies for efficiency such as Cammer factors cannot, as we explain in the next section.

THE CAMMER FACTORS ARE NOT CONCLUSIVE PROOF OF MARKET EFFICIENCY

Some scholars have identified defects in the use of Cammer factors for assessing market efficiency. Langevoort refers to the list as a “jumble,” some redundant, and “[a]s with most multi-factor lists, Cammer is unclear what is to be done except examine the factors in order. It invited an ad hoc approach informed by expert testimony, but in fact largely unconstrained.” Barber et al. (1994) also refer to the Cammer factors as “ad hoc,” and note that, “We know of no systematic body of evidence showing that these or any other criteria distinguish between efficient and inefficient stocks. Nor are we aware of evidence supporting specific cutoff values of these criteria.”

Yet, limited by the reports experts have presented to them, courts have continued to rely on Cammer factors to evaluate efficiency, viewing them as intuitive proxies for efficiency. Such a view, however, is at odds with conclusions based on rigorous economic analysis. For instance, Erenburg et al. (2011) construct different measures of weak-form efficiency (including serial correlation) for securities at issue in 236 federal securities class actions cases filed during 1996 and 1997 and find that the “actual relation of the [Cammer] factors to weak-form efficiency is sometimes the converse of the courts’ intuition.” The study concludes that:

1. some cases certified for class action status do not satisfy the conditions for even weak-form efficiency;
2. numerous opportunities exist for cost-effective investors (those who can trade quickly and at low cost) to profit by using simple momentum-based strategies;
3. including such investors as class members effectively subsidizes their strategies and overstates damages from reliance on market efficiency;
4. when such investors can profit by rejecting market efficiency, standard measures of damage overstate the fraud-related damage of other investors; and
5. because of endogeneity, the factors that commonly are relied on by the courts for determining market efficiency bear little or no relation to weak-form efficiency. [emphasis added]

Thus, Erenburg et al. (2011) noted, there is an “inconsistency between the efficient markets hypothesis and the way U.S. courts have applied the hypothesis in cases involving allegations of fraud-on-the-market.” Their “findings raise serious questions about the standards used by the courts in
granting motions for class action status and about the economic appropriateness of routinely presuming universal reliance on market efficiency when certifying broad classes consisting of all investors who traded during the class period.”118

We also assess the probative value of Cammer factors next by examining seven well-known instances in which stock prices violated the Law of One Price and thus did not trade in informationally efficient markets according to prior studies. Yet, we demonstrate, they satisfied the Cammer factors indicating once again these factors have little probative value in assessing efficiency.

The case of the “twin stocks,” Royal Dutch/Shell, identified by Lamont and Thaler (2003a) is one of the stocks in our sample. In this case, a single firm, the Royal Dutch/Shell Group, has two sets of traded shares (Royal Dutch shares traded in Amsterdam and Shell shares traded in London). Contractually, Royal Dutch shares receive 60% and Shell shares receive 40% of the firm’s cash flows. Therefore, the market value of the Royal Dutch shares should be 1.5 times the market value of Shell shares. However, as Lamont and Thaler (2003a) found, this ratio has varied considerably from its theoretical value, “from 30 percent too low in 1981 to more than 15 percent too high in 1996.” The authors noted that such a large and persistent violation of the Law of One was “surprising since both Royal Dutch and Shell trade in highly liquid and open markets in Europe and, additionally, have ADRs trading in the United States. Thus, to profit from the mispricing, a U.S. investor doesn’t even need to trade in international markets. All that is necessary is to short the overpriced shares, buy the underpriced shares and hold forever.”119

In another study, Lamont and Thaler (2003b) identified a sample of 18 cases from April 1996 to August 2000 of companies that conducted initial public offerings (IPOs) in a subsidiary (known as a “carve-out”)120 with the announced intention of spinning off the rest of the subsidiary to the parent company’s shareholders at a later date. In six cases, the aftermarket price of the subsidiary was so high that if the same value was attached to the remaining shares owned by the parent, the implied value of the rest of the parent’s assets would be negative, which is of course impossible in an efficient market because a stock investment represents limited liability (i.e., a shareholder’s loss is limited to the amount he paid for the shares). For example, in 1999 the Silicon Valley technology company, 3Com spun off a small portion of its handheld computer division, Palm, through an IPO, while retaining 95% of Palm which would be distributed in about six
months to 3Com shareholders, when each 3Com shareholder would receive 1.5 shares of Palm. Hence, following Palm’s IPO, each 3Com share was expected to be valued at 1.5 times the price of a Palm share, plus the per share value of the remainder of the 3Com business (excluding Palm). However, after its IPO, Palm’s stock price rose significantly while that of 3Com actually fell,121 to the point that the market value of the 95% stake in Palm that 3Com still held was higher than the remaining business of 3Com, i.e. the rest of 3Com’s business had a negative value (−$22 billion). This irrational mispricing was widely discussed in the press the day after Palm’s IPO, “including in two articles in the Wall Street Journal, one in the New York Times, and … USA Today.”122 In another instance, Fedenia and Hirschey (2009) found Chipotle’s Class A shares traded at a premium to Class B shares even though the former had inferior voting rights.123

Table 1 lists the cases we have analyzed and their relevant analysis periods.124 Each of these represents a well-known case of securities that have not traded in informationally efficient markets for specific periods.

As Table 2 shows, despite violating the Law of One Price and trading in an inefficient market over particular analysis periods, these securities satisfied the Cammer factors (such as sufficient average weekly trading volume, analyst coverage, market capitalization, and a low bid-ask spread)125 over their respective analysis periods and were publicly traded on NYSE/NASDAQ.126 Among the criterion for eligibility to file form S-3, the Court in Cammer noted that it is “the number of shares traded and value of shares outstanding that involve the facts which imply efficiency.” As Table 2 shows, all the firms had significantly higher market capitalization compared to the required public float to be eligible to file form S-3.127

To assess the fifth Cammer factor, we analyzed the stock price reaction to earnings announcements in the cases of (i) the five parent companies which had negative stub values following their subsidiaries’ spin-offs listed in Table 1, panel A; and (ii) the Royal Dutch ADR, the Shell ADR, the Chipotle Class A, and the Chipotle Class B shares, listed in panel B of Table 1.128 We identified 38 instances in which these companies announced quarterly earnings that constituted a “surprise”129 relative to the consensus (mean) analyst forecast and were not coupled with any confounding news (See Table 3). In 35 of these 38 cases, these companies’ stock prices moved immediately in the right direction, i.e., increased following a positive earnings surprise and declined following a negative surprise. We also confirmed that in these 35 cases the price reactions were in the right direction even on a market-adjusted basis, using the typical market model we see in many
Table 1. Analyzed Securities that Violated the Law of One Price Under Factors Were Satisfied.

<table>
<thead>
<tr>
<th>#</th>
<th>Parent Subsidiary</th>
<th>Analysis Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parent</td>
<td>Subsidiary</td>
</tr>
<tr>
<td>A: Instances in Which the Parent Company’s Assets Had “Negative Stub” Valuea</td>
<td>Creative Computers stock</td>
<td>UBID stock</td>
</tr>
<tr>
<td></td>
<td>HNC Software stock</td>
<td>Retek stock</td>
</tr>
<tr>
<td></td>
<td>Daisytek stock</td>
<td>PFSWeb stock</td>
</tr>
<tr>
<td></td>
<td>3Com stock</td>
<td>Palm stock</td>
</tr>
<tr>
<td></td>
<td>Chipotle Class A Stock</td>
<td>Chipotle Class B Stock</td>
</tr>
</tbody>
</table>

aIn the five “negative stub” cases, the implied market value of the parent company’s residual assets (excluding the value of its shares in a spin-off subsidiary) was negative following the spin-off (or IPO of shares) of a subsidiary [See Lamont and Thaler (2003b)]. For the negative stub cases identified by Lamont and Thaler (2003b) that we have analyzed, the analysis periods are as defined by Lamont and Thaler (2003b). The analysis period for the Chipotle case is as defined in Fedenia and Hirschey (2009), which documented Chipotle’s violation of the Law of One Price. See Lamont and Thaler (2003a), which documented the Royal Dutch and Shell pricing anomaly from 1990 to August 2002. For illustrative purposes, we have focused on the sub-period January 1, 1997–June 30, 2002, which spans more than five years, in our analysis of the Royal Dutch/Shell example.

bIn the Royal Dutch/Shell example, the Royal Dutch ADR’s claim to the cash flows of the Royal Dutch/Shell Plc. was 1.5 times that of the Shell ADR’s claim. Yet, the market value of the Royal Dutch ADR violated parity (i.e., 1.5 times the value of the Shell ADR) consistently for almost a decade [See Lamont and Thaler (2003a)]. In the Chipotle case, Chipotle had two classes of traded shares. Even though they had inferior voting rights, however, the Class A shares were found to have traded “at a persistent price premium of as much as 20% more than superior Class B shares.” See Fedenia, M. and Hirschey, M. (2009), The Chipotle paradox. Journal of Applied Finance, Issues 1 & 2, pp. 1–16.
### Table 2. Cammer – Unger Factor Related Evidence for Selected Securities.

<table>
<thead>
<tr>
<th>#</th>
<th>Security</th>
<th>Start Period</th>
<th>End Period</th>
<th>Average Weekly Turnover (%)</th>
<th>Number of Analysts</th>
<th>Date of Earliest S-3/F-3 Filings(a)</th>
<th>Average Market Capitalization</th>
<th>Daily Average Bid-Ask Spread (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Creative Computers</td>
<td>December 3, 1998</td>
<td>June 7, 1999</td>
<td>38.43</td>
<td>3 Analysts, 8 Reports</td>
<td>October 17, 2007</td>
<td>$335,177,990</td>
<td>0.81</td>
</tr>
<tr>
<td>2</td>
<td>HNC Software</td>
<td>November 17, 1999</td>
<td>September 29, 2000</td>
<td>8.92</td>
<td>9 Analysts, 49 Reports</td>
<td>March 4, 1997</td>
<td>$1,786,106,220</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>Daisytek</td>
<td>December 1, 1999</td>
<td>July 6, 2000</td>
<td>8.10</td>
<td>6 Analysts, 17 Reports</td>
<td>February 26, 1998</td>
<td>$298,065,642</td>
<td>0.82</td>
</tr>
<tr>
<td>4</td>
<td>3Com</td>
<td>March 1, 2000</td>
<td>July 27, 2000</td>
<td>15.42</td>
<td>4 Analysts, 10 Reports</td>
<td>June 22, 1995</td>
<td>$19,037,647,538</td>
<td>0.13</td>
</tr>
<tr>
<td>5</td>
<td>Methode Electronics (Class A shares)</td>
<td>June 26, 2000</td>
<td>April 28, 2001</td>
<td>8.76</td>
<td>5 Analysts, 36 Reports</td>
<td>August 8, 1995</td>
<td>$1,090,986,919</td>
<td>0.49</td>
</tr>
<tr>
<td>6</td>
<td>Royal Dutch/Shell (Amsterdam)</td>
<td>January 1, 1997</td>
<td>June 30, 2002</td>
<td>1.45</td>
<td>101 Analysts, 1455 Reports</td>
<td>July 20, 2005</td>
<td>$45,399,477,394</td>
<td>0.11</td>
</tr>
<tr>
<td>7</td>
<td>Shell Transport &amp; Trading</td>
<td>January 1, 1997</td>
<td>June 30, 2002</td>
<td>3.39</td>
<td>101 Analysts, 1455 Reports</td>
<td>July 20, 2005</td>
<td>$1,990,918,927</td>
<td>0.33</td>
</tr>
<tr>
<td>8</td>
<td>Chipotle – Class A shares</td>
<td>October 16, 2006</td>
<td>August 31, 2008</td>
<td>23.28</td>
<td>27 Analysts, 172 Reports</td>
<td>N/A</td>
<td>$1,297,857,287</td>
<td>0.17</td>
</tr>
<tr>
<td>9</td>
<td>Chipotle – Class B shares</td>
<td>October 16, 2006</td>
<td>August 31, 2008</td>
<td>5.78</td>
<td>27 Analysts, 172 Reports</td>
<td>N/A</td>
<td>$1,484,489,924</td>
<td>0.28</td>
</tr>
</tbody>
</table>

\(a\) Date of earliest filing of form S-3 is from EDGAR database maintained by SEC. Foreign companies file form F-3. Per SEC, the general eligibility conditions to file Form F-3 are the “same as Form S-3, except the company must be a foreign private issuer (that is, not a domestic (U.S.) company).” [“Eligibility of Smaller Companies to Use Form S-3 or F-3 for Primary Securities Offerings,” available at SEC website on http://www.sec.gov/info/smallbus/secg/s3f3-secg.htm].

**Sources:** Stock price, volume and shares outstanding data is from CRSP. Number of analysts covering a company was determined using Thomson Reuters database.
Table 3. Earnings Surprise and Price Reactions.

<table>
<thead>
<tr>
<th>Security</th>
<th>Release Date</th>
<th>Event Date</th>
<th>Raw Return (%)</th>
<th>Residual Return (%)</th>
<th>t-Statistic</th>
<th>Earnings Surprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chipotle Mexican Grill Inc (Class A)</td>
<td>February 15, 2007</td>
<td>February 16, 2007</td>
<td>5.9*</td>
<td>6.0</td>
<td>2.5**</td>
<td>+</td>
</tr>
<tr>
<td>2. Chipotle Mexican Grill Inc (Class B)</td>
<td>May 1, 2007</td>
<td>May 2, 2007</td>
<td>17.9*</td>
<td>16.9</td>
<td>8.1**</td>
<td>+</td>
</tr>
<tr>
<td>3. May 1, 2007</td>
<td>August 1, 2007</td>
<td>−3.1*</td>
<td>−3.6</td>
<td>−1.4</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>4. July 31, 2007</td>
<td>August 1, 2007</td>
<td>−3.1</td>
<td>−3.6</td>
<td>−1.4</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>5. July 23, 2007</td>
<td>August 1, 2007</td>
<td>−19.7*</td>
<td>−16.6</td>
<td>−6.1**</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>6. Chipotle Mexican Grill Inc (Class B)</td>
<td>May 1, 2007</td>
<td>May 2, 2007</td>
<td>17.3*</td>
<td>16.5</td>
<td>10.5**</td>
<td>+</td>
</tr>
<tr>
<td>7. July 31, 2007</td>
<td>August 1, 2007</td>
<td>11.5*</td>
<td>10.3</td>
<td>4.9**</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>8. July 23, 2007</td>
<td>August 1, 2007</td>
<td>−1.5*</td>
<td>−1.9</td>
<td>−0.7</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>10. Creative Computers (PC Mall Inc)</td>
<td>February 8, 1999</td>
<td>February 8, 1999</td>
<td>−3.3*</td>
<td>−5.0</td>
<td>−0.5</td>
<td>−</td>
</tr>
<tr>
<td>12. HNC Software</td>
<td>April 19, 2000</td>
<td>April 20, 2000</td>
<td>−3.5</td>
<td>−4.6</td>
<td>−0.8</td>
<td>+</td>
</tr>
<tr>
<td>13. July 19, 2000</td>
<td>July 20, 2000</td>
<td>−3.6</td>
<td>−5.0</td>
<td>−0.9</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>14. Royal Dutch Petroleum</td>
<td>May 6, 1999</td>
<td>May 6, 1999</td>
<td>2.8*</td>
<td>3.7</td>
<td>1.8</td>
<td>+</td>
</tr>
<tr>
<td>15. August 5, 1999</td>
<td>August 5, 1999</td>
<td>3.6*</td>
<td>3.1</td>
<td>1.4</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>16. February 10, 2000</td>
<td>February 10, 2000</td>
<td>5.0*</td>
<td>4.8</td>
<td>2.6**</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>17. February 8, 2001</td>
<td>February 8, 2001</td>
<td>0.2*</td>
<td>0.2</td>
<td>0.1</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>18. May 2, 2002</td>
<td>May 2, 2002</td>
<td>2.0*</td>
<td>2.1</td>
<td>1.5</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>19. August 7, 1997</td>
<td>August 7, 1997</td>
<td>−4.0*</td>
<td>−3.4</td>
<td>−3.5**</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>20. February 12, 1998</td>
<td>February 12, 1998</td>
<td>−1.6*</td>
<td>−2.1</td>
<td>−1.6</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>21. August 6, 1998</td>
<td>August 6, 1998</td>
<td>−7.0*</td>
<td>−8.0</td>
<td>−5.5**</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>22. November 5, 1998</td>
<td>November 5, 1998</td>
<td>−3.3*</td>
<td>−4.6</td>
<td>−2.6**</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>23. February 11, 1999</td>
<td>February 11, 1999</td>
<td>−2.1*</td>
<td>−4.1</td>
<td>−2.0**</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>Release Date</td>
<td>Event Date&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Raw Return (%)</td>
<td>Residual Return (%)</td>
<td>t-Statistic</td>
<td>Earnings Surprise&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>----------</td>
<td>--------------</td>
<td>-------------------------</td>
<td>----------------</td>
<td>---------------------</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td>25.</td>
<td>November 4, 1999</td>
<td>November 4, 1999</td>
<td>−5.0&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−5.4</td>
<td>−2.9**</td>
<td>−</td>
</tr>
<tr>
<td>26.</td>
<td>November 2, 2000</td>
<td>November 2, 2000</td>
<td>−6.8&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−7.0</td>
<td>−3.6**</td>
<td>−</td>
</tr>
<tr>
<td>27. Shell</td>
<td>May 6, 1999</td>
<td>May 6, 1999</td>
<td>3.9&lt;sup&gt;*&lt;/sup&gt;</td>
<td>4.6</td>
<td>2.3**</td>
<td>+</td>
</tr>
<tr>
<td>28.</td>
<td>August 5, 1999</td>
<td>August 5, 1999</td>
<td>4.9&lt;sup&gt;*&lt;/sup&gt;</td>
<td>4.4</td>
<td>2.1**</td>
<td>+</td>
</tr>
<tr>
<td>29.</td>
<td>February 10, 2000</td>
<td>February 10, 2000</td>
<td>8.2&lt;sup&gt;*&lt;/sup&gt;</td>
<td>7.9</td>
<td>4.1**</td>
<td>+</td>
</tr>
<tr>
<td>30.</td>
<td>February 8, 2001</td>
<td>February 8, 2001</td>
<td>−0.2</td>
<td>−0.1</td>
<td>−0.1</td>
<td>+</td>
</tr>
<tr>
<td>31.</td>
<td>May 2, 2002</td>
<td>May 2, 2002</td>
<td>−0.2</td>
<td>−0.1</td>
<td>−0.1</td>
<td>+</td>
</tr>
<tr>
<td>32.</td>
<td>August 7, 1997</td>
<td>August 7, 1997</td>
<td>−4.7&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−4.2</td>
<td>−4.3**</td>
<td>−</td>
</tr>
<tr>
<td>33.</td>
<td>February 12, 1998</td>
<td>February 12, 1998</td>
<td>−1.1&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−1.5</td>
<td>−1.2</td>
<td>−</td>
</tr>
<tr>
<td>34.</td>
<td>August 6, 1998</td>
<td>August 6, 1998</td>
<td>−4.4&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−5.1</td>
<td>−4.0**</td>
<td>−</td>
</tr>
<tr>
<td>35.</td>
<td>November 5, 1998</td>
<td>November 5, 1998</td>
<td>−4.1&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−5.2</td>
<td>−3.2**</td>
<td>−</td>
</tr>
<tr>
<td>36.</td>
<td>February 11, 1999</td>
<td>February 11, 1999</td>
<td>−2.6&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−4.2</td>
<td>−2.3**</td>
<td>−</td>
</tr>
<tr>
<td>37.</td>
<td>November 4, 1999</td>
<td>November 4, 1999</td>
<td>−5.1&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−5.4</td>
<td>−2.9**</td>
<td>−</td>
</tr>
<tr>
<td>38.</td>
<td>November 2, 2000</td>
<td>November 2, 2000</td>
<td>−6.4&lt;sup&gt;*&lt;/sup&gt;</td>
<td>−6.7</td>
<td>−3.2**</td>
<td>−</td>
</tr>
</tbody>
</table>

<sup>a</sup>Raw return is consistent with earnings surprise.

<sup>b</sup>Market-adjusted return is statistically significant and in the right direction.

<sup>a</sup>Event date is the trading day on which impact of earnings announcement is analyzed. For earnings announced after trading hours, event day equals the first trading day following announcement of earnings.

<sup>b</sup>Positive and negative earnings surprise are denoted by “+” and “−”.
economic reports for class certification purposes.\textsuperscript{130} Further, the market-adjusted price reaction was statistically significant and in the right direction in 25 of the 38 cases analyzed.\textsuperscript{131}

In short, the securities analyzed above satisfied the \textit{Cammer} factors, including appearing to satisfy the test for cause and effect. However, these securities traded in markets that were clearly inefficient over the relevant analysis periods. This finding confirms that even if a stock satisfies an ad hoc list of factors considered indications of efficiency, it does not constitute adequate proof that the stock actually traded in an efficient market.

**THE GLOBAL LIQUIDITY CRISIS OF 2007–2008, LIMITS TO ARBITRAGE AND MARKET INEFFICIENCY**

A global liquidity and credit crisis of unprecedented magnitude erupted on August 9, 2007, when France’s largest bank, BNP Paribas, announced that it had frozen redemptions for three investment funds, because of the “complete evaporation of liquidity in certain market segments of the US securitization market [which had] ... made it impossible to value certain assets fairly regardless of their quality or credit rating.”\textsuperscript{132} When liquidity, a key ingredient for arbitrage evaporates, it triggers several knock-on effects that amplify economic shocks to a “full-blown financial crisis.”\textsuperscript{133} As Brunnermeier (2009) noted, “When asset prices drop, financial institutions’ capital erodes and, at the same time, lending standards and margins tighten. Both effects [which Brunnermeier referred to as ‘liquidity spirals’] cause fire-sales, pushing down prices and tightening funding even further.” The mortgage crisis also amplified because (i) runs on financial institutions, like those on Bear Stearns, Lehman Brothers, and Washington Mutual, suddenly eroded bank capital and (ii) financial counterparties began to hold additional funds to protect themselves from counterparty risk that are not netted out (which can occur when multiple trading parties fail to cancel out offsetting positions because of concerns about counterparty credit risk).

The liquidity crunch resulted in the LIBOR-OIS spread,\textsuperscript{134} which former Fed Chairman Greenspan described as a “barometer of fears of bank insolvency”\textsuperscript{135} tripling overnight from 13.4 basis points (bps) on August 8 to nearly 40 bps on August 9, 2007. Central banks around the world injected liquidity into their national banking systems to prevent asset sales at
depressed “fire-sale” prices and further deleveraging by broker dealers.\textsuperscript{136} Noting that loss of confidence in markets due to false rumors could result in panic selling, and led stock prices to “artificially and unnecessarily decline well below the price level that would have resulted from the normal price discovery process,”\textsuperscript{137} the Securities and Exchange Commission (“SEC”) banned naked short selling of the stocks of 19 major financial institutions on July 15, 2008 and nine days later announced that it would expand the list of companies covered by the ban to the entire market.\textsuperscript{138}

Despite these measures, by September 2008 the financial markets were on the brink of collapse and illiquidity had reached unprecedented proportions. By the end of that month, the financial landscape was forever changed as several large financial institutions were either taken over by the U.S. government, failed or merged with other firms. On Sunday, September 7, 2008, Freddie Mac and Fannie Mae (government-sponsored entities established to provide liquidity in the secondary mortgage market) were put into receivership by the U.S. government in one of the largest bailouts in U.S. history. On Monday, September 15, 2008, Lehman Brothers Holdings Inc. filed for bankruptcy protection — “one of the biggest credit events in history”\textsuperscript{139} and Merrill Lynch announced it would be acquired by Bank of America. On September 16, 2008, AIG, a major insurer of credit risk, was taken over by the U.S. government.\textsuperscript{140} A wave of deposit withdrawals triggered the failure of the Seattle thrift, Washington Mutual, the largest bank failure in U.S. history\textsuperscript{141} and Goldman Sachs and Morgan Stanley, the only two large remaining U.S. investment banks announced plans to become bank holding companies to obtain liquidity from the U.S. Federal Reserve.\textsuperscript{142}

As noted earlier, markets are rendered efficient through the costly efforts of arbitrageurs to gather relevant information and trade to profit from such information. Such arbitrage is essential for a market to be informationally efficient. Arbitrage is conducted mainly by institutional investors such as hedge funds that rely on external funding.\textsuperscript{143} Thus, when investors withdrew their capital from hedge funds during the crisis, the funds’ ability to arbitrage by purchasing additional undervalued assets became severely limited and funds were forced to sell assets at a huge loss. In 2008, the typical fund lost about one-fifth of its value and “convertible arbitrage” funds (that try to exploit price anomalies among corporate bonds) lost 46%, their worst losses since 1990, according to \textit{The Economist}. Over the next few quarters, the number of funds, which had risen to over 7,000, was estimated to fall by half.\textsuperscript{144} The \textit{Economist} article noted that hedge funds’ lack of liquidity was “simply another part of a vast, debt-dependent ecosystem that is now being starved of oxygen.”\textsuperscript{145}
Numerous recent academic studies too have documented that the liquidity crisis limited arbitrage and rendered markets inefficient. For instance, Pedersen (2009) focuses on “quants” (quantitative traders who use algorithmic trading strategies) and finds that in early August 2007 such traders “ran for the exits” as liquidity froze. As a result, the cumulative return to a long–short market-neutral value and momentum strategy for U.S. large-cap stocks displayed “amazing short-term predictability and volatility,” which was clear evidence that even large-cap stocks’ prices during this period were not informationally efficient.

Hu, Pan, and Wang (2010) demonstrate that even the U.S. Treasury market, the largest, safest, and most liquid asset market in the world, was rendered inefficient during the fall of 2008. Griffoli and Ranaldo (2010) from the Swiss National Bank found that the covered interest parity (a no-arbitrage condition) was persistently violated during the crisis. Garleanu and Pedersen (2011) study the credit default swaps-bond “basis”, which is a measure of the price discrepancy between corporate bonds and CDS, which are securities with nearly identical economic exposures. Thus in a well-functioning market, the basis should be zero, which was not the case during the crisis (i.e., the Law of One Price was violated).

In sum, security markets are not always efficient. For markets to be efficient, it is essential that arbitrageurs have the incentive and the ability to take advantage of temporary mispricing in securities (given available information). Indeed, it is through such arbitrage that markets become efficient. Thus, arbitrage is the lifeblood of an efficient market and limits to arbitrage can result in a security trading at prices that are obviously informationally inefficient for extended periods. The most recent and dramatic instance of such inefficiency occurred during the global financial crisis of 2007–2009 when several assets markets became acutely dislocated.

CONCLUSION

To seek class certification under Rule 23, securities fraud plaintiffs must prove with rigorous analysis that the security at issue traded in an efficient market in which its price fully reflects all available information throughout the alleged class period. Instead of using well-accepted empirical tests of market efficiency that are grounded in the economic principles of market efficiency theory, courts are often presented with expert testimony that is limited to a mechanical review of ad hoc Cammer factors. Courts usually grant class certification without having the benefit of rigorous economic
analysis. Our analysis confirms that the factors have little probative value in assessing efficiency. We show that even stocks that have violated the Law of One Price, a fundamental condition for efficiency according to several well-known prior studies, satisfy the Cammer factors. Thus, a review of Cammer factors does not constitute rigorous analysis that the Supreme Court in Wal-Mart ruled was necessary for class certification.

Further, the market efficiency hypothesis on which the Supreme Court adopted its judicial doctrine of fraud-on-the-market in Basic in 1988 has been challenged on several fronts in the last 25 years. Today, market efficiency is not considered a foregone conclusion in every instance. In particular, during severe financial crises such as the one during 2007–2008, arbitrage (the mechanism through which markets become efficient) can be severely restricted. Then, as numerous studies have confirmed, various asset markets can be dislocated and security prices become informationally inefficient.

In light of such modern economic research, the continued reliance on the fraud-on-the-market doctrine (and market efficiency) is questionable, as dissenting opinions in the recent Supreme Court decision in Amgen have noted. At the very least, courts should require plaintiffs invoking the fraud-on-the-market doctrine to prove the market for the security at issue was efficient throughout the relevant class period using rigorous analysis based on scientific methods that have been well developed in the economics profession over the past 25 years. If security prices are obviously severely dislocated due to limits to arbitrage it is unreasonable to assume that investors would have relied on the “integrity” of such prices. Hence, a mechanical review of Cammer factors which are ad hoc and fail to distinguish between securities that trade in an efficient market from those that do not, does not constitute sufficiently rigorous economic analysis for proving reliance based on the fraud-on-the-market doctrine.

NOTES

3. See, for example, Langevoort (2009).


10. Basic, 485 U.S., at 243, 245 (citations omitted). See also Halliburton, 131 S. Ct., at 2185; Stoneridge Invest. Partners, LLC v. Scientific-Atlanta, Inc., 552 U.S. 148, 159 (2008) (“[U]nder the fraud-on-the-market doctrine, reliance is presumed when the statements at issue become public. The public information is reflected in the market price of the security. Then it can be assumed that an investor who buys or sells stock at the market price relies upon the statement.”).


12. Amgen, 133 S. Ct., at 1213 (Thomas, J., dissenting). “The fraud-on-the-market rule says that purchase or sale of a security in a well-functioning market establishes reliance on a material misrepresentation known to the market. This rule is to be found nowhere in the United States Code or in the common law of fraud or deception; it was invented by the Court in Basic Inc. v. Levinson, 485 U.S. 224 (1988).” Ibid., at 1205 (Scalia, J., dissenting).


15. PolyMedica I, 432 F.3d, at 8.

16. Halliburton, 131 S. Ct., at 2186 (emphasis added). See also Amgen, 133 S. Ct., at 1195 (Basic presumption “is premised on the understanding that in an efficient market, all publicly available information is rapidly incorporated into, and thus transmitted to investors through, the market price.”).

17. Amgen, 133 S. Ct., at 1192.

18. As Grundfest (2013) noted, “Basic was decided at a time when confidence in the efficient market hypothesis was at its historic peak. Since then, a large literature challenging the efficient market hypothesis has emerged, but that literature has spawned an equally vigorous defense. The debate over market efficiency is nuanced and complex, and it implicates fine points of econometrics and finance theory. It splits leading scholars.”

19. “Correctly” in this context merely means that the market has placed its best aggregate estimate on the value of information; the efficient capital markets hypothesis does not assume that the valuation of a security at a particular point in time will be accurate as a predictive matter, only that it incorporates the collective judgment of the market as to the best estimate of that valuation based on all available public information as of that point in time.

As a legal matter, the First Circuit has ruled that reliance requires only “informational efficiency” and not “fundamental value efficiency” i.e., the market price must rapidly reflect all public information but not necessarily be the best possible estimate of the stock’s actual worth. In re PolyMedica Corp. Sec. Litig., 432 F.3d 1, 14–19 (1st Cir. 2005) (“PolyMedica I”) (holding that “the market price of the stock fully reflects all publicly available information. By ‘fully reflect,’ we mean that market price responds so quickly to new information that ordinary investors cannot make trading profits on the basis of such information”). This distinction may be
meaningful in clarifying what the courts mean by efficiency, in the sense that they ordinarily do not need to receive evidence on the generally speculative question of whether the market price was “right” about the value of the company. But as an economic matter, it is not very important. A security’s price on any current date is simply the sum of its historical price at some earlier date and the cumulative price changes thereafter through the current date. If a security trades in an informationally efficient market in which it correctly impounds all new information, then, as a cumulative effect of such price reactions, the security’s price converges over time to its fundamentally efficient value.

20. If information-gathering and trading costs exist, “[a] A weaker and economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed the marginal costs.” [Fama (1991), p. 1575].


22. Amgen, 133 S. Ct., at 1192.

23. Halliburton, 131 S. Ct., at 2182, 2185.

24. 133 S. Ct. at 1198 (citing Wal-Mart, 131 S. Ct., at 2542 n. 6).

25. Ibid., at 1210.

26. Wal-Mart, 131 S. Ct., at 2551 (emphasis in original).

27. Ibid.


29. Wal-Mart, 131 S. Ct., at 2561.

30. Comcast, 133 S. Ct., at 1435 n. 6.

31. Amgen, 133 S. Ct., at 1191.

32. Amgen, 133 S. Ct., at 1198.

33. As the Court held in Halliburton, proof of how and when inflation exits the price is not required to invoke the presumption at the class certification stage, although the Court in that case did not address any situation in which there were individual variations in how inflation was dissipated from the price.

34. Amgen, 133 S. Ct., at 1192.

35. This is true not only with regard to misrepresentations but with regard to other statements considered in the mix of public information. For example, under Basic, courts will commonly presume that markets incorporate disclosures that rendered the alleged misrepresentation stale or immaterial. See, for example, Teachers’ Ret. Sys. of Louisiana v. Hunter, 477 F.3d 162, 187–188 (4th Cir. 2007); In re Merck & Co., Inc. Secs. Litig., 432 F.3d 261, 270 (3d Cir. 2005) (“[a]n efficient market for good news is an efficient market for bad news”); Greenberg v. Crossroads Sys., Inc., 364 F.3d 657, 665–666 (5th Cir. 2004) (“confirmatory information has already been digested by the market and will not cause a change in stock price.”); Oran v. Stafford, 226 F.3d 275, 282 (3d Cir. 2000) (Alito, J.). The entire project of determining the effect of information in the market over the course of the class period on a common basis assumes that each piece of information entering the market was so reflected.

36. See, for example, Virginia Bankshares, Inc. v. Sandberg, 501 U.S. 1083, 1092–1096 (1991) (declining to permit litigation confined solely to questions of motivation, unless testable by objective evidence); Blue Chip Stamps v. Manor Drug Stores, 421 U.S. 723, 743 (1975) (warning against litigation of “hazy issues of
historical fact the proof of which depended almost entirely on oral testimony” regarding whether investors would have bought or sold stock). See also Anza v. Ideal Steel Supply Corp., 547 U.S. 451 (2006) (rejecting “speculative” theory of RICO damages in light of “the difficulty that can arise when a court attempts to ascertain the damages caused by some remote action” and the “intricate, uncertain inquiries” needed to ascertain damages); The Wharf (Holdings) Ltd. v. United Int’l Holdings, Inc., 532 U.S. 588, 594–595 (2001) (permitting litigation over oral sales where, unlike Blue Chip Stamps, “both parties would be able to testify as to whether the relevant events had occurred”); Banca Cremi, S.A. v. Alex. Brown & Sons, Inc., 132 F.3d 1017, 1035 (4th Cir. 1997) (court “acutely uncomfortable” with theory of liability where “every element of fraud — materiality, reliance, scienter, and proximate cause of damages — is inferred or can be presumed.”).

37. “The two men, leading proponents of opposing views about the rationality of financial markets — a dispute with important implications for investment strategy, financial regulation and economic policy — were joined in unlikely union Monday as winners of the Nobel Memorial Prize in Economic Science. Mr. Fama’s seminal theory of rational, efficient markets inspired the rise of index funds and contributed to the decline of financial regulation. Mr. Shiller, perhaps his most influential critic, carefully assembled evidence of irrational, inefficient behavior and gained a measure of fame by predicting the fall of stock prices in 2000 as well as the housing crash that began in 2006.” (Binyamin, 2013).

38. According to the “behavioral finance” literature (which is now widely accepted and for which the Nobel Prize was recently awarded), investors do not necessarily act rationally, rationally, and their “irrational” behavior affects their attitudes toward risk and their assessment of probabilities [See Barberis and Thaler (2003). The effect of such irrational behavior, especially if it is systemic, may make a market inefficient. Standard graduate texts also now cover behavioral finance. See, for example, Brealey et al., pp. 326–327.]

39. This result, known as the “Grossman–Stiglitz Paradox,” was first articulated by Nobel laureate Joseph Stiglitz and Sanford Grossman [See Grossman and Stiglitz (1980)].

40. As Fisher Black, a preeminent financial economist (of Black—Scholes option pricing theory fame) noted in his presidential address to the American Finance Association, “All estimates of value are noisy, so we can never know how far away price is from value. However, we might define an efficient market as one in which price is within a factor of 2 of value, i.e., the price is more than half of value and less than twice value.1 The factor of 2 is arbitrary, of course. Intuitively, though, it seems reasonable to me, in the light of sources of uncertainty about value and the strength of the forces tending to cause price to return to value.” [See Black (1986), p. 533].

41. See, for example, Lamont and Thaler (2003a, b) and Mitchell, Pulvino, and Stafford (2002).


43. See Brealey et al., p. 321.

44. See, for example, Fama and French (2012) and Erenburg et al. (2011).

45. See, for example, Langevoort (2009).


49. Unger v. Amedisys, Inc., 401 F.3d 316, 323 (5th Cir. 2005) (collecting cases). Cammer identified the first five factors, see Cammer v. Bloom, 711 F. Supp. 1264, 1286–1287 (D.N.J. 1989); later courts added the other three. See Krogman v. Sterritt, 202 F.R.D. 467 (N.D. Tex. 2001). For ease of discussion, unless otherwise noted, we shall henceforth refer to all factors identified in Krogman, Unger, and Cammer (except, the cause-and-effect factor), collectively as the “Cammer factors.”


52. For example, Barber, Griffin, and Lev (1994) examine if Cammer factors can differentiate stocks that are (semi-strong form) efficiently priced (display a price response to an announcement of an extreme earnings surprise) from those that are not (i.e., lack such a price response to an announcement of an extreme earnings surprise). They find that except for trading volume and number of analysts following the stocks, other factors commonly used (firm size, percentage of bid-ask spread, return volatility, price, and institutional holdings) “either fail to significance test or yield results counter to our expectations” [Barber et al. (1994), p. 310] i.e., have no probative value in this context. Note however, that even the two factors that Barber et al. (1994) identified as potentially useful in distinguishing stocks as semi-strong form efficient were not useful in detecting weak-form efficiency (an essential first step in any efficiency analysis) according to Erenburg et al. (2011)’s study which we discuss in greater detail later.

53. See Erenburg et al. (2011) and Barber et al. (1994). The only Cammer factor that is recognized in the economics profession is the “cause-and-effect” factor, which plaintiffs typically seek to demonstrate by providing “event study evidence.” However, as we discuss later, such evidence constitutes proof of “semi-strong form efficiency,” which is moot if the stock does not even trade in a “weak-form efficient” market.

54. Dunbar and Heller (2006), Abstract, p. 455. Notable exceptions in this regard being the case of Freddie Mac’s NYSE-traded Series Z preferred stocks in Freddie Mac, and more recently, George v. China Auto. Sys., Inc., 11 CIV. 7533 KBF, 2013 WL 3357170 (S.D.N.Y. July 3, 2013), in which the plaintiffs’ proof of market efficiency related to the securities at issue was considered inadequate by the court.

58. Brief for Former SEC Commissioners and Officials and Law and Finance Professors as Amici Curiae Supporting Petitioners, Amgen v. Connecticut Ret. Plans and Trust Funds, 133 S. Ct. 1184 (2013) (No. 11–1085), 2012 WL 3555291. “Of the 92% of cases resolved prior to issuance of a ruling on summary judgment, 41% are dismissed, and 51% are settled.” Ibid.
60. Amgen, 133 S. Ct., at 1193 & 1197 n. 6.
61. Ibid., at 1206 (Scalia, J., dissenting).
62. Ibid., at 1208 n. 4 (Thomas, J., dissenting).
63. Ibid.
64. Ibid., at 1197 n. 6 [quoting Langevoort (2009)].
65. Amgen, 133 S. Ct., at 1204 (Alito, J., concurring).
67. In their survey of the efficient market literature, economists at the Reserve Bank of Australia noted that “Within a decade, the efficient market hypothesis was so well established that Jensen (1978) was prompted to write that he believed there to be ‘no other proposition in economics which has more solid empirical evidence supporting it’. Such confidence portends a reversal, and the subsequent twenty years of research and asset-market experience have rendered the efficient market hypothesis a much more controversial proposition.” [Beechey, Gruen, and Vickery (2000), p. 21].
68. Maier and Herath (2009) provide a recent survey of tests of market efficiency in real estate markets. They conclude based on their comprehensive survey of the empirical literature on the topic that “the result found in the literature is inconclusive. Majority of studies provide evidence supporting inefficiency of the real estate market while several studies maintain the notion of real estate market efficiency.” [Maier and Herath (2009), p. 1].
71. Fama (1970) discusses a momentum strategy known as the y% filter strategy. He notes, “But when one takes account of even the minimum trading costs that would be generated by small filters, their advantage over buy-and-hold disappears.” [Fama (1970), p. 396]. Ferrillo et al. (2004), p. 103. (“The main implication of the EMH [Efficient Market Hypothesis], when it holds, is that an investor cannot earn an above-average return by using stale or previously known information.”).
72. See, for example, PolyMedica I, 432 F.3d, at 10.
73. See Erenburg et al. (2011).
74. As explained in the text notes of Bodie et al., “This version of the hypothesis is quite extreme. Few would argue that the proposition that corporate officers have access to pertinent information long enough before public release to enable them to profit from trading on that information. Indeed, much of the activity of the Securities and Exchange Commission is directed toward preventing insiders from profiting by exploiting their privileged situation.” [Bodie, Kane, and Marcus (2008), p. 361].
77. Hu and Marcus (2012) incorrectly claim that “it is a generally accepted and articulated principle in the finance literature that serial correlation in daily stock returns and deviations from the random walk model are not necessarily proof of market inefficiency,” citing certain theoretical studies by LeRoy (1973) and Lucas (1978) to buttress their claim. These theoretical studies, which consider abstract theoretical paradigms that bear little relevance to the real world, do not demonstrate that that periods of serial correlation are “not incompatible with efficiency of the
market,” as Hu and Marcus assert. For instance, Lucas (1978) analyzes the “stochastic behavior of equilibrium asset prices in a one-good, pure exchange economy,” i.e., an economy in which there is only a single good produced, all consumers are identical (in terms of their preferences and wealth) and the good is “perishable,” i.e., there is no means of storing the good for future consumption. In other words, financial securities that allow one to save for future do not exist in this hypothetical world. Given such perishability, consumers are willing to pay relatively more for the good in a drought year compared to a normal year (i.e., declining marginal utility of consumption which manifests itself in risk aversion) which creates predictability in prices. Such a theoretical model and its conclusions bear little resemblance to the real world. Similarly, Leroy (1973) assumes, among other things that, “all earnings on stock are paid out in dividends” (i.e., companies cannot retain any earnings for future investment needs), each investor holds “an equal share of the equity and an equal allocation of cash,” and “can always make an unbiased forecast of the price of stock.” Leroy himself notes that some of his model’s assumptions are “particularly unrealistic,” and consequently, his conclusion that, in theory, the “return on stock will not satisfy the martingale property [i.e., display serial correlation] was proved only in a very restricted context.” He concludes that his article “demonstrated, then, not that any particular systematic departure from the martingale property is to be expected, but. . . if capital markets are efficient, rates of return will follow a martingale distribution as a fair approximation [i.e., data will not empirically show serial correlation].” Contrary to Hu and Marcus’ assertion that “If one were to accept the premise that deviations from the random walk model make a security market inefficient, then one would have to conclude that almost all publicly traded stocks . . . are inefficient as well,” the Lo and MacKinlay (1988) study that Hu and Marcus themselves noted that there was no evidence of significant serial correlation on average across their sample of 625 stocks. While minor “spurious” negative serial correlation due to market frictions, such as lack of trading as Hu and Marcus note, in practice the odds of detected serial correlation being spurious is extremely low as Lo and MacKinlay (1990) confirm. These authors demonstrate that for even minimal spurious serial correlation (of −0.37%) to be detected in daily returns data, the stock’s lack of trading would have to be extreme, i.e., the stock could trade no more than once every “35.4 days.” In short, as, a study by Professor Timmermann and Nobel Laureate Clive Granger (which Hu and Marcus also cite) noted, if serial correlation in a stock’s returns is found to be “large enough to cover the size of transaction costs,” the finding “invalidate[s]” the conclusion that the stock trades in an efficient market.

85. As noted above, Erenburg et al. (2011) consider serial correlation as well as momentum trading rules to detect weak-form inefficiency.
86. Fama (1970) describes the y-filter rule as: “If the price of a security moves up at least y%, buy and hold the security until its price moves down at least y% from a subsequent high, at which time simultaneously sell and go short. The short position is maintained until the price rises at least y% above a subsequent low, at which time one covers the short position and buys. Moves less than y% in either direction are ignored.” [Fama (1970), pp. 394–395]. A buy-and-hold strategy is a passive strategy in which the stock is bought and held until the end of the analysis period. The weak-form market efficiency model that Fama (1970) considers in this connection is referred to as a sub-martingale in prices, according to which in an efficient market investors expect next-period returns on a stock to be greater than or equal to zero [See Fama (1970), p. 386].

87. Fama (1970) cautions that y-filter trading rule profits may arise because transaction costs such as commissions are ignored. Thus, to have probative value from an economic perspective, y-filter tests of weak-form efficiency should incorporate the transaction costs (commissions and bid-ask spreads) that implementing such a strategy would actually entail.


89. For instance, Jegadeesh and Titman (1993) documented that stocks with strong past performance continue to outperform stocks with poor past performance in the next period with an average excess return of about 1% per month over the 3–12 month horizon. In a more recent study, Fama and French (2012) examined momentum in four regions (North America, Europe, Japan, and Asia Pacific) and found “momentum everywhere” except Japan [See Fama and French (2012)].

90. “An efficient market is one in which the market price of the stock fully reflects all publicly available information.” PolyMedica I, 432 F.3d, at 10.


93. The t-statistic is a ratio of the residual return and its standard error (or the “standard deviation” of the residual return over the estimation period, where the term “standard deviation” refers to the average squared difference of a variable’s observed values compared to the variable’s mean value). A t-statistic with an absolute value of 1.96 or greater means that the residual return is statistically significant at the 95% confidence level, i.e., there is only a 5% chance that the residual return can be attributed to chance. In such instances, the residual returns are typically considered “statistically significant.”


95. The courts have recognized that this is a corollary of the efficient markets hypothesis. See, for example, In re Omnicom Group, Inc. Secs. Litig., 597 F.3d 501, 512 (2d Cir. 2010). See also supra n. 32.

96. For instance, Macey, Miller, Mitchell, and Netter (1991) argue, “We suggest that the focus of the Supreme Court’s holding in Basic is misplaced: what determines whether investors were justified in relying on the integrity of the market price is not the efficiency of the relevant market but rather whether a misstatement distorted the price of the affected security … [which can be determined using a] simple empirical technique, called an event study … Whenever event study methodology
shows that a fraudulent event has had a statistically significant effect on the price of a firm’s securities, courts are justified in presuming reliance under the fraud-on-the-market theory.” [Macey et al. (1991), p. 1018.]

97. Analysis of the security’s price change following on such dates may well be relevant to the plaintiffs’ loss causation and damage claims, which the Supreme Court has noted need not be proven for class certification. See Halliburton, 131 S. Ct., at 2186–2187.

98. This follows from the fact that the adjustment made for contemporaneous changes in market and industry benchmarks in standard event studies is typically small over daily horizons.

99. By the same logic, an event study of selected dates during the alleged class period (which may or may not be mentioned in the complaint) when the price change was known to be large and significant, and the expert found some positive (or negative) news ex post that were consistent with the direction of the observed price change does not prove cause-and-effect. Instead, such a claim is an instance of the well-known “post hoc” fallacy. (The Latin term for the fallacy is post hoc, ergo propter hoc [“After this, therefore because of this”] and refers to the incorrect conclusion that if an event of kind A is followed in time by an event of kind B, then A must have caused B.)


101. Ibid.

102. That is Ferrillo, Dunbar, and Tabak’s test compares the percentage of days with news that have a statistically significant price movement to the percentage of days without news that have a statistically significant price movement [Ferrillo et al. (2004, p. 120)].

103. Freddie Mac, 281 F.R.D., at 180 (emphasis added).

104. Ferrillo et al. (2004), p. 120.

105. “The Fisher's Exact and Chi-Square tests [proposed by Ferrillo, Dunbar, and Tabak] do not show that the price of Series Z consistently responded to unexpected, material news.” (Freddie Mac, 281 F.R.D., at 180).

106. This is one reason why the Fifth Circuit does not permit claims to be asserted on such a theory of confirmatory misrepresentation. See Greenberg v. Crossroads Sys., Inc., 364 F.3d 657, 665–666 (5th Cir. 2004).

107. Comcast, 133 S. Ct., at 1433.

108. Freddie Mac, 281 F.R.D., at 180 (emphasis added).

109. Another one of this article’s authors, Mr. McLaughlin, was one of the counsel representing one of the defendants in Freddie Mac.

110. Ibid.


112. See Lamont and Thaler (2003a, b), Ofek, Richardson, and Whitelaw (2004), and Battalio and Schultz (2006). As Lamont and Thaler (2003b) noted, “Do arbitrage trades actually enforce the law of one price? This empirical question is easier to answer than the more general question of whether prices reflect fundamental value. Tests of this more general implication of market efficiency force the investigator to take a stance on defining fundamental value. Fama (1991, p. 1575) describes this difficulty as the “joint-hypothesis” problem: “market efficiency per se is not testable.
It must be tested jointly with some model of equilibrium, an asset-pricing model.” “In contrast, one does not need an asset-pricing model to know that identical assets should have identical prices.” [Lamont and Thaler (2003b), p. 228].

113. See Battalio and Schultz (2006) for a discussion of Law of One Price tests using put-call parity including the use of such tests for dividend paying stocks.

114. Barber et al. (1994).


119. All quotes in this paragraph are from Lamont and Thaler (2003a), p. 195.


121. Following its IPO, Palm closed at $95.06 on its first day of trading while 3Com closed at $81.81 [See Lamont and Thaler (2003b), p. 230].


123. See Fedenia and Hirschey (2009).

124. For the “negative stub” cases identified by Lamont and Thaler (2003b) that we have analyzed, the analysis periods are as defined by Lamont and Thaler (2003b). The analysis period for the Chipotle case is as defined in Fedenia and Hirschey (2009), which documented Chipotle’s violation of the Law of One Price. Lamont and Thaler (2003a) documented the Royal Dutch and Shell pricing anomaly from 1990 to August, 2002. For illustrative purposes, we have focused on the January 1, 1997–June 30, 2002 sub-period, which spans more than five years, in our analysis of the Royal Dutch/Shell example.

125. Historical data over the relevant analysis period regarding the number of market makers for the securities analyzed are unavailable on widely recognized databases for such data, e.g., Bloomberg and the Center for Research on Security Prices (CRSP). Public float data were only available for Chipotle Class A and Class B shares over the relevant analysis period. However, the average bid-ask spread during the analysis period for most of the securities listed in Table 2 was lower than $2—2.15% which represent the average traded stock’s percentage quoted spread on the NYSE and Nasdaq, respectively, for a sample spanning the two weeks immediately after the beginning of decimal trading in the Nasdaq market: April 9—20, 2001 [“Comparing Bid-Ask Spreads on the New York Stock Exchange and Nasdaq Immediately Following Decimalization,” prepared by NYSE Research, July 26, 2001]. Such low bid-ask spreads are indicative of sufficient activity by market makers who provide liquidity in a security by posting bid and ask quotes at which they are willing to buy or sell the security immediately, respectively. Over the analysis period, the public float for Chipotle Class A and Class B shares was 98% and 93%, respectively, as a percentage of total shares outstanding [Source: Bloomberg L.P.].


127. A company was required to have an outstanding float over $150 million held by nonaffiliates, or $100 million of such float coupled with annual trading volume exceeding 3 million shares at the time of Cammer Opinion, and the threshold for float has since been reduced to U.S. $75 million. As we noted earlier, public float data are available only for Chipotle Classes A and B shares over the analysis period. For both Chipotle class A and class B shares, average public float during
We determined the earnings announcement date and time through Factiva, a Dow Jones product, which is a widely used database containing news from worldwide sources.

We compute earnings surprise for the firm as the excess of actual earnings over the mean estimate of analysts. We obtained data on mean earnings estimate and actual earnings from Thomson Reuters I/B/E/S data base, which is a well-known database that “provides detailed and consensus estimates featuring up to 26 forecast measures including GAAP and pro-forma EPS, revenue/sales, net income, pre-tax profit and operating profit, and price targets and recommendations for more than 60,000 companies in 67 countries worldwide.” (http://thomsonreuters.com/products_services/financial/financial_products/a-z/ibes/, downloaded August 1, 2011). We verified the earnings surprise with information contained in news articles through Factiva, if such information was available. In case the earnings surprise based on news articles was different from the earnings surprise based on IBES data, I used the earnings surprise based on news articles because IBES updates its database once a month.

The event study first uses a regression model to estimate the historical relationship between the subject stock’s daily return to that of a market index (in this case the S&P 500 index), or the index “beta,” over an estimation period. We defined the estimation period to be the 252 days preceding each earnings surprise date analyzed, except in three instances, when price data were unavailable for 252 days prior to the earnings surprise. In these three cases, the estimation period comprised of the maximum number of days for which such price data were available. Then, given the observed change in the market index on the event date at issue (when the earnings surprise was announced), and the estimated beta, the stock’s expected return is calculated.

Even though the price reaction was not in the right direction on three occasions, the market-adjusted returns on these occasions were insignificant, confirming that the earnings news considered in these cases was immaterial, after adjusting for contemporaneous changes in the market index.


Brunnermeier (2009), p. 78.

“The 3-month London Interbank Offered Rate (LIBOR) is the interest rate at which banks borrow unsecured funds from other banks in the London wholesale money market for a period of 3 months. Alternatively, if a bank enters into an overnight indexed swap (OIS), it is entitled to receive a fixed rate of interest on a notional amount called the OIS rate. In exchange, the bank agrees to pay a (compound) interest payment on the notional amount to be determined by a reference floating rate (in the United States, this is the effective federal funds rate) to the counterparty at maturity. … Entering into the OIS exposes the bank to future fluctuations in the reference rate. However, the bank can guarantee itself longer-term funding while still paying close to the overnight rate. Because the alternative would be rolling over the funds on a daily basis at changing overnight rates, banks are willing to pay a premium. This is reflected in the LIBOR-OIS spread (defined as
the difference between the LIBOR rate and the OIS rate.” [Sengupta and Tam (2008)].


138. Wutkowski and Younglai (2008). The SEC’s ban on naked short selling meant that in order to short sell a company’s stock investors would have to first borrow the stock.

139. BIS (2008), p. 4.

140. For example, on September 16, 2008, the government extended a two-year emergency loan of $85 billion to AIG, a major insurer of credit risk, and in exchange was entitled to 79.9% equity ownership of the company through preferred stock (AIG Annual Report for 2008, p. 1).


147. Hu et al. (2011) focus on the U.S. Treasury market for three reasons: (i) the market’s global importance and use of Treasury yields as pricing benchmarks for other securities; (ii) its safety (or absence of credit risk) which implies that price deviations in the U.S. Treasury market are likely to provide information about liquidity shortages per se and not be contaminated by other risk factors that typically affect other security prices; and (iii) its significant liquidity relative to other asset markets, which implies that a shortage of liquidity in this market would constitute a strong signal about liquidity in the overall market [See Hu et al. (2011), pp. 1–2].


149. Covered interest parity (CIP) arbitrage entails borrowing in one currency and lending in another to take advantage of interest rate differentials while avoiding exchange rate risk. “Arbitrage normally ensures that covered interest parity (CIP) holds. Until recently, excess profits, if any, were documented to last merely seconds and reach a few pips. Instead, ... following the Lehman bankruptcy, these were large, persisted for months and involved strategies short in dollars.” [Griffoli and Ranaldo (2010)].

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