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Revisiting The Mechanisms of Market Efficiency

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MARKET INDETERMINACY

Abstract

“Market indeterminacy” is the inability to determine whether asset prices are efficient or inefficient, that is, whether or not asset prices fully and immediately reflect available information, such that no investor can earn abnormal expected returns by trading on available information at current prices. Market indeterminacy pervades asset markets because we lack reasonably precise models of “correct” prices, sometimes called models of “fundamental value,” against which we can compare observed asset prices to detect efficiency and inefficiency. Arbitrageurs face market indeterminacy as well, so there is little reason to think that professional arbitrage will inevitably drive prices to fundamental values. Market indeterminacy casts doubt on the usefulness of the market efficiency concept in law and policy. For example, contrary to current practice, there is insufficient scientific basis to characterize some markets as efficient, and others as inefficient for purposes of the fraud-on-the-market theory of securities law. Market indeterminacy also undermines the reliability of event studies in some litigation and policy applications, and makes it hard to regulate financial markets.

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***518 I. Introduction**

Ronald Gilson and Reinier Kraakman wrote *The Mechanisms of Market Efficiency* at the end of an optimistic time for market efficiency proponents.¹ For academic lawyers able to wade through the financial economics literature in the early 1980's, the field offered theoretical and empirical achievements with numerous apparent implications for corporate and securities law.² In the midst of this intellectual gold rush, Gilson and Kraakman showed commendable prudence, stopping to ask a basic but important question: “What makes the market efficient when it appears to be so?”³ Without an answer to that elementary question, various proposed legal reforms supported by the supposed “fact” of market efficiency might accidentally interfere with the processes that presumably caused prices to be efficient in the first place.⁴

With the benefit of twenty years of hindsight, Gilson and Kraakman's inquisitiveness remains impressive, but the focus of their concern--How do we explain the "fact" of market efficiency?--seems less vital.⁵ As the 1980's progressed, much empirical evidence began to undermine the efficient markets paradigm. The "certain anomalies" that Gilson and Kraakman dismissed in 1984 soon became a torrent.⁶ The U.S. stock market crash of 1987 and the quick rebound that followed caused many to be unsure whether prices were "efficient" at most points in time, even prices of the largest and most liquid stocks. The rise and fall of the Japanese stock market generated more skepticism about market efficiency.⁷ In the early 1990's, academic economists began to develop theoretical models that asked the almost heretical question whether arbitrage was actually powerful enough to keep prices efficient.⁸ The empirical death of the widely accepted Capital Asset Pricing Model (and its ubiquitous "market beta" measure of risk) followed by 1992.⁹ The stock market's high valuation of internet and technology stocks in the late 1990's contributed greatly to skepticism of efficient markets theory. The same market's decline in 2000-2002 put a large dent in the financial security of many stock market investors (including foreign investors) taught to believe that market prices were *519 efficient and reliable signals of investment value.¹⁰ Considering developments since 1984, the "fact" of market efficiency may hardly seem factual at all.

At the same time, no paradigm as encompassing as market efficiency has taken its place. Economists working in the emerging field of behavioral finance argue that market inefficiency pervades asset markets. Their research has advanced the decline of market efficiency as the only accepted academic description of financial markets, and fostered an active and ongoing debate in financial economics. But behavioral finance has not yet provided much in the way of predictive models, nor do available behavioral theories match the theoretical richness of the rational paradigm.¹¹ Instead, current behavioral models are best understood to provide ex post "explanations" demonstrating how psychological biases might produce observed asset pricing anomalies.¹² While indicative of the role that psychology might play in market pricing, behavioral theories still beg many questions, such as how different individual biases would combine to affect asset pricing (for example, what impact does "optimism" have when combined with "loss aversion"), and, most importantly, how irrationality-induced anomalies survive market arbitrage forces if they ever arise in the first place.¹³ We can state the second question another way. How do financial anomalies survive if they are caused by irrationality? Behavioral finance has offered only preliminary answers.¹⁴ While behavioral finance has *520 made important empirical and theoretical contributions, it is too soon to tell whether it can provide a comprehensive theory of asset pricing to replace the dominant rational paradigm, even if fewer find the rational paradigm persuasive.¹⁵

We use this retrospective on Gilson and Kraakman's *The Mechanisms of Market Efficiency* to question the usefulness of the market efficiency/inefficiency dichotomy for law and policy. The fixation on market efficiency versus market inefficiency ignores a critical reality about our knowledge of financial markets that is increasingly hard to disregard: we have almost no ability to identify a reliable line separating efficient and inefficient prices. "Market indeterminacy" is the term we use to describe the inability to determine whether market prices are efficient or not. This Article explores causes and consequences of market indeterminacy: why does market indeterminacy exist, and what implications does it have for law and policy?

What we call "market indeterminacy" has a respectable pedigree in financial economics. At the 1986 meetings of the American Finance Association, just two years after the publication of *The Mechanisms of Market Efficiency*, Professor (later Secretary of the Treasury) Larry Summers explained that our tests of market efficiency have almost no power to distinguish between market efficiency and inefficiency.¹⁶ In his well-known Presidential Address at those same meetings, Fischer Black (whose joint work on option pricing led, after his death, to a Nobel Prize for his co-author Myron Scholes) expressed similar skepticism about the ability to determine whether prices are efficient or not.¹⁷ Some of the world's most successful investors express related views. Toiling in the real world of arbitrage and the constant hunt for mispricing, these investors seem to reject both traditional notions of market efficiency and the idea that psychology creates easy to identify occurrences of market inefficiency.¹⁸

*521 Still, market indeterminacy has few friends in academia. Those who hold a more hopeful view of asset pricing theory--from the perspectives of either rational or behavioral finance--resist the arguably pessimistic view of asset pricing that we share with Black and Summers.¹⁹ Policy proposals that depend on the ability to draw a reliable line between efficient and inefficient market prices are irrelevant if that task is impossible (or, at least, not yet possible).²⁰ Those whose theories depend on the unambiguous existence of either efficient or inefficient markets are obviously reluctant to question the market efficiency/inefficiency dichotomy or the limits of the social science they invoke to support it.²¹

In Part II we explore causes of market indeterminacy. We start by setting out a standard definition of market efficiency. Market efficiency requires that an asset price fully and immediately reflect available information, such that no investor can earn abnormal expected returns by trading on the available information at the current price. In order to determine whether prices are efficient or not, we must be able to determine whether the current price reflects all available information and is “correct” such that no investor can invest at that price and expect to earn abnormal returns. That is, we need a model of “fundamental value” into which we put the “available information” and out of which we receive a price at which no abnormal expected returns are possible. If the current price is lower than the calculated price, then positive expected abnormal returns probably exist. If the current price is higher than the calculated price, then negative expected abnormal returns probably exist.²² In either case, we must be able to compare the current price to a predicted “correct” price to determine if the current price is efficient or not.

*522 Having determined that market efficiency cannot be detected reliably without reasonably precise models of fundamental value, we take the short step to market indeterminacy by acknowledging that reliable models of fundamental value are virtually nonexistent. It surprises many non-economists to learn that financial economists have been unable to develop reliable models of “fundamental value.” We trace the lack of fundamental value models both to the inherent complexity of the valuation problem and, related to this complexity, to the traditional research strategy of financial economics. Generating a solution to the problem of fundamental value modeling requires confronting almost overwhelming uncertainty in forecasting the evolution of probable determinants of value such as cash flows and systematic risks. Perhaps as a result, the research strategy of financial economics has concerned itself little with the problem of practical asset pricing (that is, what should the price of this asset be?). Rather, financial economists concern themselves mostly with the equilibrium behavior of returns (not prices) assuming they are set by investors in specified ways that the economist cannot, himself, easily replicate (for example, what returns should be earned by this asset, through time and compared to other assets, assuming that investors are “hedging” their consumption?).²³ This strategy explores fascinating and worthwhile questions, but it has done very little to tell researchers or investors how to calculate asset prices. Without reasonably precise models of fundamental value, our tests of market efficiency have almost no power to detect market efficiency when it exists, or reject it when it does not.

Why then, in the absence of reliable models of fundamental value, do so many finance researchers and legal academics seem to believe that market prices are efficient? We first trace this belief to a misplaced confidence in short run event studies as tests of market efficiency. Short run event studies often fail to reject the hypothesis of market efficiency, and it is from such evidence that market efficiency proponents take their greatest comfort.²⁴ What users of short run event studies often fail to acknowledge, however, is that short run event studies lack statistical power against most alternative market inefficiency hypotheses. That is, short run event studies would fail to reject the null hypothesis of market efficiency in many (perhaps most) cases when prices actually are inefficient.²⁵

*523 Much faith in market efficiency also seems to rest on a strong belief in the power of arbitrage.²⁶ The financial economist's inability to reliably detect market efficiency would indeed be less bothersome to efficient market theory if we knew that market forces inevitably drive prices to correct levels. But why should they? Those who believe that arbitrage will drive prices to “correct” levels never tell us with any specificity how arbitrageurs are able to determine when prices are wrong.²⁷ Rather, academic faith in arbitrage, both in law and, more surprisingly, in financial economics, has long been mostly non-empirical and rhetorical, resting on beliefs and assertions about how arbitrage “ought” to work rather than knowledge about how it actually does. Without evidence that arbitrageurs have significantly better models of “fundamental value” than available in academia,

we are skeptical of claims that arbitrageurs find a way to push prices to their “correct” level.²⁸ Instead, most real world arbitrage concerns “relative” valuation--does this asset price make sense in light of other current asset prices?--a focus that may leave all or most prices incorrect in an absolute sense. Arbitrageurs are often in possession of incredibly sophisticated models of relative valuation, but such models provide no guarantee that prices will converge to fundamentally “correct” models. Interestingly, the same advocates of market efficiency who place great faith in the power of informed trading also embrace, as evidence of market efficiency, that most money managers are unable to beat the market average.²⁹ But this is hardly supportive of an active and successful arbitrage process, and instead is equally consistent with a world where market indeterminacy makes both arbitrage and performance measurement extremely difficult.

In Part III we turn to some normative consequences of market indeterminacy. *524 Market indeterminacy casts doubt on the usefulness of the market efficiency concept in law and policy. For example, there is insufficient scientific basis to support one of market efficiency's work horse legal jobs: supporting the conclusion that a presumption of reliance should be available to investors in an efficient market, the so-called fraud-on-the-market theory of federal securities law. In addition, market indeterminacy undermines the reliability of event studies in at least some litigation and policy applications. Undetectable market inefficiencies cause prices and price reactions to be incorrect even when price reactions are immediate, and short run drift is not apparent. This does not undermine event studies for all purposes. As others have pointed out, event studies can tell us whether prices reacted strongly to information or not and thus may retain usefulness in some applications.³⁰ But event studies do not tell us whether price reactions are correct or reasonable, or in any meaningful sense, “efficient.” For some purposes (i.e., cost-benefit analysis and some damages analysis), this limitation may be too severe to allow event studies much influence in real disputes and policy debates.

Part IV concludes by exploring how market indeterminacy might affect future law and policy research.

II. Causes of Market Indeterminacy

A. Market Efficiency Tests Lack Power

We define market indeterminacy as the inability to determine whether market prices are efficient or inefficient. We start by defining what we mean by “efficient” or “market efficiency.” To us, the following is an uncontroversial definition: A market price is efficient when it fully and immediately reflects available information,³¹ such that no investor can earn abnormal expected returns by trading on the available information at the current price.³²

Given this definition, how do we determine whether a price is efficient or not? To test whether a price is efficient, a natural first step would be to collect the available information, and then calculate the price that fully reflects the available information, and does not allow abnormal expected returns. The second step would be to compare that calculated price to the current price. The current price is efficient if it is identical to the calculated correct price (allowing for a margin of error due to transactions costs).³³

*525 Unfortunately, we cannot implement this natural test of market efficiency because we do not know how to “calculate the price that fully reflects the available information and would not allow abnormal expected returns.” That is, we do not know how to calculate the “correct” price³⁴ (its “fundamental value”) given “available information” (of course, collecting all the “available information” is another problem altogether).³⁵ While it may surprise those unfamiliar with the financial economic literature, available fundamental value models built on earnings or discounted cash flows yield very imprecise predictions for the value of financial assets, so imprecise that they pose great risk in use as investment guidance.³⁶

*526 Rather than focusing on models of fundamental value (that is, the determination of asset prices), most financial economists focus on equilibrium asset pricing models that generate predictions regarding return behavior, setting their sights on changes in asset prices³⁷ rather than asset prices themselves. This approach sidesteps the problem of describing in practical detail

how investors form price estimates in the first place. After decades of empirical research, the evidence is generally inconsistent with the implications of those models that make reasonably sharp predictions about asset return behavior, leaving financial economists with neither good models of prices nor accepted models of return behavior.³⁸

Thus, though the problem is easily stated, it proves remarkably vexing to actually test whether prices are efficient or not. Even the most ardent proponents of market efficiency and rational asset pricing acknowledge that many existing asset pricing tests have almost no power to determine whether prices are efficient or not.³⁹ Financial economists ascribe this unfortunate state of affairs to the “joint hypothesis” problem. As Professor Fama writes, “It is a disappointing fact that, because of the joint-hypothesis problem, precise inferences about the degree of market efficiency are likely to remain impossible.”⁴⁰ What Professor Fama calls the joint-hypothesis problem is simply the finance literature's name for a more general problem recognized in the philosophy of science. When scientists test hypotheses, they test not only the central hypothesis (for example, prices are efficient) but also the many auxiliary propositions (for example, prices are set according to some specified asset pricing model). If the data disconfirm the ***527** central prediction (finding, for example, that prices appear predictable, as in many long run event studies), then the researchers can fault the auxiliary components, shielding the central hypothesis from complete rejection.⁴¹ Put more colorfully, the joint hypothesis problem allows a researcher to shoot the auxiliary assumptions, leaving the central hypothesis to live another day.

In asset pricing tests, the joint hypothesis problem arises from a now familiar problem: we do not know the model of fundamental value that should determine asset prices and, by consequence, asset returns. Thus, we must test the hypothesis of “market efficiency” jointly with a guess about the model of asset market equilibrium that determines the behavior of asset returns. Put another way, we have to speculate about the model that determines how asset returns “should” behave in equilibrium before we can test whether prices are behaving that way or not in response to new information. If our asset pricing tests reject the market efficiency hypothesis, that may mean that markets are inefficient. But it may also mean that we picked the wrong asset pricing model.⁴²

How, in the face of the joint hypothesis problem, do serious financial economists come to such strong beliefs about market efficiency? It is interesting to first explore some evidence believers in market efficiency do not take seriously: evidence on long run event studies which, when applied, tend to reject the market efficiency hypothesis. Long run event studies explore the behavior of asset returns years after an event.⁴³ Because the effects of a “bad” asset pricing model may accumulate over time and cause a false rejection of the market efficiency hypothesis, Professor Fama argues that long run event studies are too susceptible to the joint hypothesis problem to be taken seriously.⁴⁴ He points out that rejections of market efficiency often disappear (or significantly diminish) when researchers use different benchmarks for expected returns.⁴⁵ He thus characterizes long term results as “fragile,”⁴⁶ suggesting that market inefficiencies implied by long run event studies are unlikely to be important if they are sensitive to different model benchmarks.⁴⁷

***528** But such fragility has alternative interpretations that might be more supportive of market inefficiency. Mispricing detected with one asset pricing model may disappear when a substitute model is used if the substitute model generates returns that reflect the same pattern of mispricing generated by the event firm. This possibility is especially serious since most of the fragility of long run returns arises from use of the multifactor models to calculate benchmark returns, such as Professor Ross's Arbitrage Pricing Theory⁴⁸ and Professor Merton's Intertemporal CAPM.⁴⁹ Because these models specify neither the number nor identity of the risk factors they are meant to reflect,⁵⁰ they are easy interpretive devices to explain factors that have been mined from the data ex post. If those factors (such as the superiority of small firms or value firms or firms with high return momentum) reflect irrationality, but are labeled “rational” by inclusion in the benchmark model, researchers may fail to detect market inefficiency even when it exists. Perhaps the best that can be said of long run event study evidence is that it is highly ambiguous.⁵¹

Rather than long run event studies (which, if anything, tend to hurt the case for market efficiency), it is evidence from short run event studies that girds the faith of most market efficiency proponents. Professor Fama calls event studies “the cleanest evidence we have on efficiency With few exceptions, the evidence is supportive.”⁵² Event studies are relatively simple in theory.⁵³ They ask simply whether realized post-event returns are too large or too small to be consistent with “expected” returns following the event. If they are too large or too small, it is possible that the information in the event was not fully reflected in the price on the event day. That delay would reject the hypothesis of market efficiency--that information is fully and immediately reflected in the price at the event.

Market efficiency advocates embrace short run event study evidence because the *529 “joint hypothesis” problem seems less important when tests are conducted over short time horizons. Over a few days, weeks or months, expected returns from almost any generally accepted model of expected returns are quite low and not highly variable from model to model. For example, the predicted expected return from a simple-CAPM over three or six months will not be that different from that predicted by a multifactor model or a benchmark portfolio.⁵⁴ Thus, if market efficiency is rejected, it is highly unlikely that the rejection arises from a bad model of rational returns. Every reasonable model would predict the same basic benchmark return, so the rejection must be attributed to something else, including the falsity of the maintained hypothesis of market efficiency.

We believe the widespread faith in short run event studies is largely misplaced. Short run event studies have power only against alternative specifications of market inefficiency where incomplete or incorrect price reactions reveal themselves over short horizons. Potentially, this restricts short run event studies to situations where disconfirming news arises quickly after the event, forcing a revision in beliefs (formed just days or weeks before) that is reflected in detectable jumps or drifts in asset prices. Short run event studies will have very low power against alternative specifications of market inefficiency where revision of beliefs takes place, if at all, only over longer periods of time as disconfirming news is revealed. That sort of market inefficiency may manifest only in small abnormal returns that are virtually undetectable by current tests (which may fail to reject the null hypothesis of no drift) so it is impossible to conclude that a quick reaction and lack of drift in the “short run” provides powerful evidence in favor of market efficiency.⁵⁵ This is the problem first emphasized by Professor Summers.⁵⁶

Relying only on the magnitude of short run drift to detect market inefficiency, short run event studies can allow substantial mispricing to go undetected in prices and event day reactions. Consider the constant growth Gordon model. Remembering our earlier cautions, we note that we have no idea whether asset prices are actually set by anything like the Gordon model. Still, the Gordon growth model captures the intuition of more *530 complicated rational asset pricing models that price assets as the present value of future cash flows. In the model, asset price at time t , P_{t-1} , is given by

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where D_t denotes next year's dividend, g_{t-1} , the annual growth rate of dividends, and, r , the annual expected rate of return demanded by investors given its perceived systematic risk. For simplicity, we assume the expected return is constant. Variables known to investors prior to the event are denoted with a subscript $t-1$ and subsequent to the event by subscript t .

On date t assume there is news about the growth rate of dividends, g . This is the unexpected “event” of our model. We will focus here on errors in expected returns, not errors in cash flow forecasts, so we assume that the market accurately revises its expectations from g_{t-1} to g_t . That is, the market gets the cash flow impact right by assumption. Let

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g denote this change. The typical “abnormal return”, AR , observed on the event day is approximately the percent change in the stock price given by:

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We say “approximately” because we have not subtracted the “expected” return on the event day. Because the expected return on the event day is approximately zero, we follow the views of short run event study proponents and assume we can ignore its impact on event day returns.⁵⁷ It is crucial to note, however, that this does not mean that the expected return is unimportant in a short run event study. The expected return enters the price of the asset and the abnormal return through r . Thus, even at event day the expected return model plays a large role in price and price reactions, as we now show.

We now turn to our primary concern: what if r is wrong? The possibility of expected return errors is beginning to receive attention in academic finance.⁵⁸ Expected return errors may create very large mispricing effects even when they are seemingly “small.” In Table I we illustrate how expected return errors affect prices. We fix the growth rate of dividends, g_{t-1} , at 4% and calculate the resulting percentage errors in price. It is easy to see that small positive errors in expected return can cause very large errors in underlying asset prices. Given the Gordon growth model as our asset pricing framework, the size of these errors depends on the difference $r-g$ in the denominator.

*531 Table I

Sensitivity of asset prices to errors in expected rate of return

This table provides percentage errors in price as a function of differing amounts of induced errors in expected return, r . We calculate prices using the Gordon model in which the growth rate, g , equals 4%, and next period dividend is set to one dollar. In each column, we assume a different level of “true” expected return, r , and calculate both the correct price, P_{true} , had the market used the correct discount rate, as well as the percentage errors in the price when incorrect levels of the discount rate is used. We present 11 rows with different levels of expected return misspecification ranging from -5% to 5%.

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Errors in expected returns also affect event day abnormal returns. The percentage change in AR with respect to small expected return error is given by:

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Therefore, if the expected return is incorrect by an amount $\triangle r$, the resulting percentage change in the AR is approximately given by

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On inspection, it is easy to see that, like the error in prices, the error in the event-day abnormal return increases in the difference between investors' discount rate and the presumed new growth rate, holding constant the expected return misspecification, $\triangle r$.

Table II presents event-day abnormal returns for different parameterizations of the Gordon growth model. We fix the initial growth rate, g_{t-1} to 4% and present results for two possible changes in the growth rate. Panel A provides results for $\triangle g$ and in panel B for $\triangle g = 1\%$. In each panel we allow the “true” and unobserved expected rate of return to vary from 7 to 20%, and ask how deviations from each of these levels affect the measured abnormal return (hereinafter “AR”).

*532 Table II

Sensitivity of event-day abnormal return to errors in expected rate of return

This table provides percentage errors in calculated abnormal return (AR) as a function of differing amounts of induced errors in expected return, r . In panel A, we calculate event-day AR in which the initial growth rate g_{t-1} equals 4% and then changes to $g_t=4.1\%$. In each column we assume a different level of initial expected return, r , and calculate both the resulting AR had the market used the correct discount rate as well as the percentage errors in both the AR when incorrect levels of the discount rate are used. We present results for both positive and negative levels of expected return misspecification ranging from -5% to 5%. Panel B provides similar results in which the initial growth rate g_{t-1} equals 4% and then changes to $g_t=5\%$.

Panel A: Percentage errors in AR. $g_{t-1}=4\%$, $g_t-g_{t-1}=0.1\%$

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Panel B: Percentage errors in AR. $g_{t-1}=4\%$, $g_t-g_{t-1}=1\%$

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Consider the first column in panel A where the “correct” expected return, r , is 8 percent. The resulting “correct” abnormal return, AR, is 2.6%. If the error in the expected return, Δr , is 1%, then investors employ a discount rate equal to 9% instead of 8% and *533 AR is then 20% lower than it should be.⁵⁹ The analysis shows that if investors make mistakes in expected returns, prices and price reactions will be incorrect as well.⁶⁰ Further, even small mistakes in expected returns can cause large errors in prices and price reactions.

Simulation evidence from Professors Barber and Lyon suggests that these errors will go largely undetected.⁶¹ Here, we simply point out, analytically, that undetected inefficiencies can result in prices and price reactions that are incorrect. Note that in our example, prices do react “quickly” to news in the short run. But that quick price reaction was no guarantee that the price reaction was a correct or reasonable measure of the true value due to the change in growth rate. By construction, it was not. Further, there is no reason to believe that the type of error we explore here would be limited to only small or inactively traded stocks. If expected returns are incorrect because of possible fads or bubbles,⁶² then all assets affected by those expected returns may be mispriced. Whether they are or not may be undetectable with current methods.

B. We Can't Be Confident That Arbitrage Will Make Markets Efficient

Does it matter that financial economists have no reliable models to determine reasonably precise “fundamental values?” Perhaps arbitrageurs face fewer hurdles in forecasting demand and supply conditions, calculating expected cash flow estimates, and somehow determining discount rates that reflect time and risk preferences of the relevant investors. With their own “fundamental value” models in hand, arbitrageurs could then search the investment horizon for inefficiently priced stocks. Perhaps, in other words, we can rely on arbitrageurs to move prices to “correct” levels even when financial economists have few, if any, reliable ways to identify mispricing.

Interestingly, both rational and behavioral finance's proponents tend to assume that there are “smart” investors in the markets who can identify “fundamental values” as described above. For market efficiency's proponents, these are the investors who process *534 information correctly even when others fail and push prices to “correct” levels.⁶³ For those who believe that markets are inefficient, smart investors are those who might otherwise move prices to “correct” levels but cannot because of the “limits of arbitrage.”⁶⁴ Yet, as both proponents of market efficiency and market inefficiency seem to agree that there are smart investors in the capital markets who can identify mispricing when it exists, neither market efficiency nor inefficiency proponents present any evidence to suggest how arbitrageurs are able to determine when prices are wrong.⁶⁵

Without any evidence that arbitrageurs have better models of “fundamental value” than we know of in academia, it seems naïve to believe that arbitrageurs find easy ways to identify mispricing and push prices to their “correct” level.⁶⁶ There is no evidence

that professional investors have access to sophisticated models of fundamental value against which they can compare existing market prices.⁶⁷ To the contrary, available evidence on fundamental value pricing models used by market participants suggests that they are crude. Professors Asquith, Mikhail, and Au study how sell side analysts compute prices.⁶⁸ They examine over a thousand reports written by analysts who were members of the All-America Research Team and document the method that was used to compute forecasted equity values, often called “target prices.” They show that target prices are virtually always (99% of the time) computed simply as the product of forecasted earnings and a financial ratio (such as the price/earnings ratio). The use of more elaborate discounted cashflow models is relatively rare (13% of the time).⁶⁹ Value Line analysts calculate four-year target prices the same way, as a product of per-share forecasted earnings and price/earnings ratio.⁷⁰ That analysts use rule-of-thumb approaches to map observables like earnings into target prices suggests that analysts are not in possession of their own more sophisticated models of fundamental value. Indeed, the widespread use of market multiples suggests that even the most sophisticated investors do most of their pricing on a “relative” basis, trying to price assets according to the prices of other assets, *535 and not according to estimates of fundamental value. There is no reason to believe that such relative pricing heuristics will drive prices to “correct” absolute levels. To the extent that relative pricing heuristics (even in the form of highly quantitative statistical models) support most arbitrage activity, there is correspondingly no reason to believe that arbitrage will inevitably drive prices to correct, or efficient, levels.⁷¹

III. Some Consequences of Market Indeterminacy

A. There is No Reliable Way to Distinguish “Efficient” and “Inefficient” Markets in Fraud-on-the-Market Cases

An interesting, but troubling, use of efficient markets theory in law is that which has grown out of the Supreme Court's opinion in *Basic Inc. v. Levinson*,⁷² where the Court ruled that plaintiffs could rely on a “fraud on the market” theory of presumptive reliance as long as the security at issue traded in an “efficient” market.⁷³ Since then, federal courts have passed judgment on whether certain securities trade in efficient or inefficient markets.⁷⁴ These decisions reveal considerable lack of scientific sophistication, poor appreciation of market efficiency theory, and arbitrary variation from case to case. The use of efficient markets theory in many reported cases is inexpert at best, erratic at worst.⁷⁵

This inconsistent nature of efficient markets evidence in reported cases is perhaps unsurprising since the “science” supporting an ability to distinguish efficient and inefficient markets for litigation purposes is highly suspect. *Basic*'s need for methods to distinguish efficient and inefficient markets has generated some scholarship claiming to provide methods for detecting that difference.⁷⁶ These studies claim to identify factors *536 such as trading volume and analyst following that can distinguish efficient and inefficiently priced stocks. Whatever else such studies teach us (and they certainly have valuable empirical insights), however, it is safe to say that few in the finance profession accept them as reliable means for distinguishing efficient from inefficient prices. In fact, there are no tests for accomplishing that task that are generally accepted in the academic finance profession. Nor do such analyses rest on a testable methodology with a known rate of error since we have no way of determining how often the presence or absence of these factors misidentifies efficient stocks as inefficient or vice versa. Indeed, the fierceness of the academic debate over efficiency and inefficiency traces mostly to the inability to decide who is right, that is, to the absence of any ability to determine whether observed prices are efficient or not. For these and related reasons, we doubt such tests as are common in fraud on the market cases should pass a serious reliability review under *Daubert v. Merrell Dow Pharms., Inc.*⁷⁷

Fortunately, it is possible to take a more realistic view of the limits of financial economic science and still deal with the problem of fraud on the market. *Basic*'s fundamental teachings, and the fraud-on-the-market theory generally, need not resolve the efficiency/inefficiency debate, as Professors Macey, et al. argued more than ten years ago.⁷⁸ We can use the techniques of financial economics to determine whether news did or did not strongly affect a stock price without claiming to decide that this or that market is efficient. Courts should welcome that approach, since it fits far more comfortably with the true extent of our knowledge about asset pricing and still allows us to decide real disputes in real financial markets.

B. Market Indeterminacy Undermines the Use of Event Study Evidence in Many Litigation and Policy Applications

Event studies have taken on great prominence in litigation and policy analysis. Indeed, courts sometimes exclude the testimony of expert witnesses who fail to conduct event studies in securities fraud cases.⁷⁹ In policy, especially in securities and corporate law, most debate is heavily influenced by event study evidence.⁸⁰

We do not argue here that event studies are never useful in light of market indeterminacy. However, it is important to recognize (as our analytical example above illustrates) that event studies may leave mispricing undetected, so that both observed prices and price reactions may be wrong. At a minimum market indeterminacy requires greater caution in interpreting the results of event studies for use in both litigation and policy. In some litigation applications, it may not matter whether the price measurement is “correct” or not. For example, securities damages might compensate investors for *537 losses accompanied by fraud regardless of whether stocks are efficiently priced or not. But undetected market inefficiency may call into question proposals to use event studies for non-securities damages.⁸¹

In policy applications, market indeterminacy calls into question research that assumes markets are efficient, and then uses the event study to measure the impact of corporate events.⁸² It may be reliable to use event studies to tell us whether prices react strongly to these events, but we have almost no ability to be confident that prices reacted “correctly” or “reasonably.” Thus, for purposes like cost-benefit analysis, market indeterminacy may not allow much influence for event studies.⁸³ Market indeterminacy also casts doubt on years of academic finance research using event studies to measure the wealth impact of corporate events, at least if such evidence is interpreted as measuring the change in “fundamental value” at the time these events take place.⁸⁴

C. Market Indeterminacy Makes it Hard to Regulate Financial Markets

Market efficiency is more than one possible pricing outcome. It is the best pricing outcome possible, from a social perspective. By definition, prices can be no better than when they fully and accurately reflect available information. Efficient market prices are “right” in a normative sense. Inefficient market prices are “wrong” prices, implying the possibility of social gains if wrong prices are correctable.⁸⁵ Inefficiency seems to invite *538 regulation. The problem, of course, is that lawmakers and regulators face the same market indeterminacy faced by researchers and arbitrageurs.

For example, in a recent issue of this journal, Professor Gabaldon put forth an interesting proposal to regulate “euphoric market transactions” (for example, Internet and technology stock purchases) as gambling.⁸⁶ The problem is that market indeterminacy means that we are unlikely to be able to distinguish euphoric gambling transactions from rational, non-gambling investments.⁸⁷ We are willing to regulate gambling precisely because we understand the odds of winning and losing, and feel more comfortable making judgments about the social wisdom and propriety of making such “investments.” Matters are more complicated for stock investments, where future prospects are far more difficult to specify and virtually impossible to characterize probabilistically. Markets are different from casinos, but how different may be impossible to tell, even for a good-hearted, disinterested regulator.⁸⁸

IV. Conclusion

The broader implications of market indeterminacy remain to be explored, but promise many interesting avenues for study.⁸⁹ We live in a world where we often simply cannot tell whether prices are “correct” in terms of fundamental value. It may be more productive to turn from a debate that depends on a possibly nonexistent ability to draw a line between “efficient” and “inefficient” prices, and toward more practical questions. For example, in a world where the line between market efficiency and

inefficiency may ⁵³⁹ be unknowable, and where models of fundamental value are excessively imprecise, investors spend most of their time using relative (not absolute) valuation measures.⁹⁰ Economies where relative valuation is the only game in town, however, might be highly volatile since a small amount of news for one set of securities may lead to revisions in asset prices across a much larger group and thus create systematic risk for investors. The systematic risk of such “contagion” effects may be very hard to quantify or hedge.

Alternatively, market indeterminacy may allow prices to remain incorrect, though stably so, for long periods of time. This may cause many years of important economic decisions to rest on inefficient pricing. One possible example is housing. Housing markets have boomed in the last several years, both in the United States and in many parts of Europe. But like other assets, our models of fundamental value for housing are crude. Because it is difficult to “short” potentially overpriced real estate, optimists are likely to dominate the market.⁹¹ Market indeterminacy suggests that the large personal exposure to real estate assets created in the last several years may be highly risky. Market indeterminacy pervades many other important asset pricing problems, including the value of human capital.⁹² Addressing these and other implications of market indeterminacy may present great opportunities for future research in law and finance.⁹³

Footnotes

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¹ Ronald Gilson & Reinier H. Kraakman, [The Mechanisms of Market Efficiency](#), 70 Va. L. Rev. 549 (1984).

² See, e.g., Daniel R. Fischel, [Use of Modern Finance Theory in Securities Fraud Cases Involving Actively Traded Securities](#), 38 Bus. Law. 1 (1982).

³ See Gilson & Kraakman, *supra* note 1, at 551.

⁴ See Gilson & Kraakman, *supra* note 1, at 551, 553.

⁵ Some have long doubted the importance of that question. See Lynn A. Stout, [The Unimportance of Being Efficient: An Economic Analysis of Stock Market Pricing and Securities Regulation](#), 87 Mich. L. Rev. 613 (1988).

⁶ See Gilson & Kraakman, *supra* note 1, at 551 (“Despite certain anomalies, numerous studies demonstrate that the capital market responds efficiently to an extraordinary variety of information.”). For a valuable collection of early academic work identifying financial anomalies, see *Advances in Behavioral Finance* (Richard H. Thaler, ed., 1993).

⁷ Robert J. Shiller, Fumiko Kon-Ya, & Yoshiro Tsutsui, [Why Did the Nikkei Crash? Expanding the Scope of Expectations Data Collection](#), 78 Rev. Econ. & Stat. 156 (1996).

⁸ See, e.g., J. Bradford De Long, Andrei Shleifer, Lawrence H. Summers & Robert J. Waldmann, [Noise Trader Risk in Financial Markets](#), 98 J. Pol. Econ. 703 (1990).

- 9 See Eugene F. Fama & Kenneth R. French, *The Cross-Section of Expected Stock Returns*, 47 *J. Fin.* 427 (1992).
- 10 See, e.g., Burton G. Malkiel, *Why Markets Are Working Better*, *Wall St. J.*, Aug. 22, 1986.
- A second development, for which I am proud to have been at least partly responsible, is a growing faith in the efficiency of stock markets and a trend toward passive portfolio management. In 1973, I wrote “A Random Walk Down Wall Street,” which characterized stock markets as extremely efficient, and unmanaged index funds as outperforming about two-thirds of professionally managed portfolios. I suggested that we need funds that buy and hold the hundreds of stocks making up the broad market indexes.
- 11 See George Constantinides, *Presidential Address: Rational Asset Prices*, 57 *J. Fin.*, 1567, 1567-91 (2002) (arguing that the rational economic paradigm provides a unified theory for various assets' return premia in which investors process information rationally and whose utility is defined over consumption).
- 12 See Eugene F. Fama, *Market Efficiency, Long-Term Returns, and Behavioral Finance*, 49 *J. Fin. Econ.* 283, 285 (1998) (arguing that behavioral models “work well on the anomalies they were designed to explain. Other anomalies are, however, embarrassing”). Of course, rational theories do much the same, offering their own *ex post* explanations for how rational behavior might explain asset prices, without demonstrating much in the way of predictive success. For one view of rational finance as a largely explanatory endeavor see, Mark Rubinstein, *Rational Markets: Yes or No? The Affirmative Case*, 57 *Fin. Analyst J.* 15 (2001).
- 13 Most behavioral finance theories select only one or two biases for study, and provide only loose and heuristic arguments for why irrationality-induced behavior will survive the arbitrage process. See, e.g., Nicholas Barberis, Andrei Shleifer, & Robert W. Vishny, *A Model of Investor Sentiment*, 49 *J. Fin. Econ.* 307, 309 (1998) (studying the effects of “conservatism” and the “representativeness heuristic” and invoking unmodeled “noise trader risk” to defend price behavior against arbitrage); J.B. Heaton, *Managerial Optimism and Corporate Finance*, 31 *Fin. Mgmt.* 33, 33-34 (2002) (studying the effects of “optimism” and providing unmodeled descriptive arguments for the survival of optimism-induced effects in corporate finance).
- 14 Proponents of behavioral finance usually argue that arbitrage is limited due to risk aversion on the part of arbitrageurs or with their concern with “noise trader risk,” that is, the possibility that mispricing will actually widen in the short run, rather than revert back to fundamental value. See, e.g., De Long, Shleifer, Summers & Waldmann, *supra* note 8. But these stories lack credibility unless it is hard for the would-be arbitrageur to convince his investors to keep capital committed to his trading strategy. See Andrei Shleifer & Robert W. Vishny, *The Limits of Arbitrage*, 52 *J. Fin.* 35 (1997). One reason it may be hard to keep capital committed to arbitrage is that neither arbitrageurs nor their investors may be able to distinguish rational from irrational explanations of observed asset prices, a form of market indeterminacy. See Alon Brav & J.B. Heaton, *Competing Theories of Financial Anomalies*, 15 *Rev. Fin. Stud.* 575, 595-96 (2002) (observing that the inability to distinguish rational and behavioral explanations of financial anomalies may limit arbitrage).
- 15 See, e.g., Andrei Shleifer, *Inefficient Markets 195-197* (2000) (describing a broad range of open questions that behavioral finance needs to address in the process of generating the kind of predictions that will turn it into a legitimate alternative paradigm to rational finance).
- 16 See Lawrence H. Summers, *Does the Stock Market Rationally Reflect Fundamental Values?*, 41 *J. Fin.* 591 (1986).
- 17 See Fischer Black, *Noise*, 41 *J. Fin.* 529, 533 (1986). In this article, Black argues that:
- [W]e 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. The factor 2 is arbitrary of course. Intuitively, though, it seems reasonable to me, in light of sources of uncertainty about value and the strength of the forces tending to cause price to return to value. By this definition, I think almost all markets are efficient almost all of the time. ‘Almost all’ means at least 90%.

Id. Black's standard for efficiency is too low to be of much use. Further, Black's quantifications rest (as he admits) on arbitrary guesses and intuition. We have no idea whether the correct factor is 2 or 1 or 3 or some other number, and no idea if prices spend 90% of their time in that range or 50% or 99% or some other percentage. Id.

18 See, e.g., George Soros, *My Market Theory: Forget Theories*, *Wall St. J.*, Jan. 8, 2001, at A33 (Soros criticizes the efficient markets hypothesis, and argues that his own contrary views are dismissed because they lead:

to the conclusion that financial markets are inherently unpredictable. And what is the value of a scientific theory that does not yield usable predictions? I contend that it would be better to recognize the uncertainties inherent in the behavior of financial markets than to cling to a purportedly scientific theory that distorts reality.

Id.

19 See, e.g., Professor Stambaugh's comments on Professor Summers' paper, Robert F. Stambaugh, *Does the Stock Market Rationally Reflect Fundamental Values?: Discussion*, 41 *J. Fin.* 601, 602 (1986) ("Given past successes of the efficiency hypothesis against some alternatives, it is probably a bit harsh to characterize its acceptance as 'a shared act of faith.' Perhaps some agnosticism would be healthy, but atheism is premature.").

20 Some scholars are careful to recognize that their policy prescriptions depend on ambiguous evidence of market efficiency or inefficiency. See, e.g., Donald C. Langevort, *Taming the Animal Spirits of the Stock Markets: A Behavioral Approach to Securities Regulation*, 97 *Nw. U. L. Rev.* 135, 187 (2002) (advancing suggested changes to current securities regulation warranted by possible market inefficiencies, but cautioning that evidence of market inefficiencies "is not dispositive").

21 For an early critique of the failure to recognize the limits of the financial economics backing up the rush to incorporate market efficiency concepts into law, see Jeffrey N. Gordon & Lewis A. Kornhauser, *Efficient Markets, Costly Information, and Securities Research*, 60 *N.Y.U. L. Rev.* 761 (1985).

22 We say "probably" because we are assuming that prices that are incorrect will eventually return closer to "fundamental value" either through some process of arbitrage or because investors ultimately learn their way to correct prices. If, as we explore below, arbitrage is not reliable, then only learning may force prices to more correct levels. Much research suggests that this may be easier said than done. See, e.g., Lawrence E. Blume & David Easley, "Learning To Be Rational," 26 *J. Econ. Theory* 340, 341 (1982) (arguing that learning requires that investors are able to recognize and incorporate how their beliefs about the unknown structural features of the economy affect the structural model of the economy; if investors do not recognize the effect that learning has on prices in equilibrium, then learning the rational expectations equilibrium is not guaranteed); Lawrence E. Blume & David Easley, "Rational Expectations Equilibrium: An Alternative Approach," 34 *J. Econ. Theory* 116, 127-128 (1984) (arguing that the amount of investor knowledge required in rational expectations learning models is implausible). If neither arbitrage nor learning are possible, it may be difficult to ever reach efficiency. Put another way, if prices are incorrect, but arbitrage and learning are both ineffective, then markets may be inefficient even if no investor can expect abnormal returns at current prices.

23 See Lawrence H. Summers, *Economics and Finance*, 40 *J. Fin.* 633, 634 (1985) (arguing that financial economists "work only with hard data and are concerned with the interrelationships between the prices of different financial assets. They ignore what seems to many to be the more important question of what determines the overall level of asset prices").

24 See Eugene F. Fama, *Efficient Capital Markets II*, 46 *J. Fin.* 1575, 1602 (1991) ("Event studies are the cleanest evidence we have on efficiency With few exceptions, the evidence is supportive.").

25 As we explain below, short run event studies tell us only whether prices react quickly in the short run and do not exhibit easily detectable short run drift after an initial reaction to new information. But short run drift is a very special form of market inefficiency, one likely to occur only if a series of short run subsequent events causes investors to reconsider their initial reactions. If subsequent events (i.e., additional information that might reveal bias in previous reactions) occur more distantly and only after the passage of

some months or years, then short run evidence is unlikely to reveal inefficiency even if it exists. Only longer run evidence will establish or reject market efficiency by demonstrating whether it was possible to earn abnormal expected returns at the immediate post-information price. Unfortunately, long run event studies are hopelessly controversial absent agreement on the correct model of fundamental value. See Fama, *supra* note 12, at 285 (concluding that “[t]he bottom line is that the evidence against market efficiency from the long-term return studies is fragile. Reasonable changes in the approach used to measure abnormal returns typically suggest that apparent anomalies are methodological illusions”). Those who believe that short run event studies support market efficiency are correct in that at least some forms of market inefficiency might be detected by such tests. But they hang their faith from a thin thread, since many forms of market inefficiency (in particular, those that would manifest only in the long run) will go undetected by short run event studies.

26 See, e.g., Fischel, *supra* note 2, at 14. In his article, Fischel states:

If there are inadequate resources being devoted to information processing causing the market to be inefficient, there is a potential for entrepreneurial gain. Investors, perceiving the divergence between price and value, can secure substantial gains by purchasing underpriced shares and selling overpriced shares. This process of arbitrage would eliminate any divergences that did exist and cause the market to return to equilibrium.

Id.

27 For example, in nearly 100 pages, Gilson & Kraakman, *supra* note 1, offer no concrete examples of how traders determine efficient or inefficient prices. The abstract nature of most speculations on arbitrage hides the uncertainty that real world arbitrageurs face in real world markets. Consider, for example, David Dreman, the chairman of Dreman Value Management LLC who has for several decades now advocated that value investing is a profitable trading strategy building on investor irrationality. In a recent interview Dreman states:

Of course, it's not quite that simple. So while it may be easy enough to find stocks that are out of favor, who's to say they may not become even more out of favor? And while investors have a tendency to react to bad news by driving a company's stock price down, who's to say in any particular case that their reaction is unjustified?

Chris Pope, “Contrarian” Method Vindicated, But Few Still Have the Stomach For It, *Telegram & Gazette*, Worcester, MA, June 26, 1998, at E1.

28 Note that knowledge of fundamental values is only a necessary condition for arbitrage to work. It is not sufficient. Arbitrageurs also need to understand how prices actually are set in order to determine when, if ever, prices will return to levels that will make their arbitrage strategy pay off.

29 See Fama, *supra* note 24, at 1605-07 (reviewing evidence that professional money managers do not earn detectable abnormal returns); see also Gilson & Kraakman, *supra* note 1, at 571-72 (noting that professional managers receive only minimal abnormal returns).

30 See Jonathan R. Macey, Geoffrey P. Miller, Mark L. Mitchell & Jeffrey M. Netter, [Lessons from Financial Economics: Materiality, Reliance, and Extending the Reach of Basic v. Levinson](#), 77 *Va. L. Rev.* 1017 (1991) (arguing that event studies are useful to detect the existence of price impact from fraud even if markets are inefficient).

31 Fama, *supra* note 24, at 1575 (defining market efficiency as the “simple statement that security prices fully reflect all available information”).

32 Market efficiency is usually classified into three categories, weak form, semi-strong form, and strong form. See Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 *J. Fin.* 383 (1970). Weak form efficiency is defined as efficiency with respect to information in past prices. That is, market are weak form efficient if no profitable trading strategies can

be devised using information in past prices. Semi-strong efficiency is efficiency with respect to all publicly available information. Strong form efficiency is efficiency with respect to all available information, including private information.

- 33 Some have suggested that a finer partition of the efficiency concept is possible, arguing that there is “informational” efficiency and that informational efficiency is distinct from “fundamental value” efficiency. This terminological distinction---an invention, as far as we can tell, of the legal literature, not the financial economics literature---proposes that it is possible to determine that prices react fully and immediately to information even if we cannot determine whether prices are “correct” or not in terms of fundamental value. See, e.g., Lynn A. Stout, [Are Stock Markets Costly Casinos? Disagreement, Market Failure, and Securities Regulation](#), 81 Va. L. Rev. 611, 646-50 (1995) (distinguishing “informational” and “fundamental value” efficiency); Nathaniel Carden, [Implications of the Private Securities Litigation Reform Act of 1995 for Judicial Presumptions of Market Efficiency](#), 65 U. Chi. L. Rev. 879, n.14 (1998):

There are two forms of descriptive efficiency: “information arbitrage” and “fundamental value” efficiency. The former posits that the market digests information and that share prices move in such a way as to prevent the use of public information to earn superior returns, while the latter relates to the market's ability to reflect properly the value of the assets underlying the traded security.

Id. See also Daniel R. Fischel, [Efficient Capital Markets, the Crash, and the Fraud on the Market Theory](#), 74 Cornell L. Rev. 907, 913 (1989) (purporting to distinguish different forms of efficiency). This distinction comports poorly with views of efficiency in financial economics which generally recognize that efficiency is intimately connected with “correct” pricing. See, e.g., Robert E. Verrecchia, [On the Theory of Market Information Efficiency](#), 1 J. Acct. & Econ. 77, 78 (1979) (“When the market assessment of the underlying uncertainty of a security is sufficiently accurate, it will not be possible to earn an excess return.”) (emphasis added); see also John H. Cochrane, [Asset Pricing](#) (2001) (claiming that informational efficiency “means that market prices already contain most information about fundamental value”) (emphasis added).

- 34 We are talking here about “absolute” prices, not “relative” or “arbitrage” prices. Derivative pricing models “work” precisely because they need not solve the problem of fundamental valuation. That is, they do not require any determination whether current prices reflect all available information. Derivative prices are set from necessary arbitrage relations. This may allow most prices to be “wrong” in an absolute sense, even while the prices of assets with true arbitrage relations will be priced to eliminate arbitrage opportunities. This is possible precisely because investors can identify mispricing through the observable arbitrage relationships.

- 35 We have no doubt that market prices may incorporate far more information than any person may possess. But our inability to even identify the set of “available information” simply underscores our point that we cannot tell whether market prices reflect “fundamental values” or not. No one person is likely to have sufficient information to test whether market efficiency holds or not. There is no guarantee that prices will be “correct” simply because prices aggregate information across traders. Further, there is no evidence that investors can perform the sort of “price decoding” that Gilson & Kraakman claim will allow traders to infer from prices what information is or is not impounded in them. See Gilson & Kraakman, *supra* note 1, at 575-76.

- 36 See Jennifer Francis, Per Olsson & Dennis R. Oswald, [Comparing the Accuracy and Explainability of Dividend, Free Cash Flow, and Abnormal Earnings Equity Value Estimates](#), 38 J. Acct. Res. (2000) (examining a large sample of firms and determining that median prediction errors for the discounted abnormal earning model are large and equal to about 30%). An interesting study of the discounted cash flow valuation methodology is Stuart Gilson, Edith S. Hotchkiss, & Richard S. Ruback, [Valuation of Bankrupt Firms](#), 13 Rev. Fin. Stud. 43 (2000). They find very large valuation errors in their study of discounted cash flow methods in bankruptcy. Another study, claims greater success, but its tests are controversial. See Steven N. Kaplan & Richard Ruback, [The Valuation of Cash Flow Forecasts: An Empirical Analysis](#), 50 J. Fin. 1059 (1995). Those authors compare transaction prices of highly leveraged transactions to valuations performed on the projections developed in such deals. Because transaction prices may be hard-wired to projections, there are potential endogeneity problems in the study that casts some doubt on its results. In general, the poor performance of these models is hardly surprising. At a minimum, the fundamental value problem requires the forecast of demand and supply conditions, resulting expected cash flow estimates, and discount rates that reflect time and risk preferences of the relevant investors.

- 37 See Constantinides, *supra* note 11, at 1567 (“A central theme in finance and economics is the pursuit of a unified theory of the rate of return across different classes of financial assets. In particular, we are interested in the mean, co-variability, and predictability of the return of financial assets.”).
- 38 In the category of models with reasonably sharp predictions about asset return behavior, we include, of course, the classic work of Professors Sharpe and Lintner. See William F. Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, 19 J. Fin. 425 (1964); John Lintner, *The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets*, 47 Rev. Econ. & Stat. 13 (1965). Even these models have serious problems that some have argued render them untestable. See Richard Roll, *A Critique Of The Asset Pricing Theory's Tests; Part I: On Past And Potential Testability Of The Theory*, 4 J. Fin. Econ. 129 (1977) (arguing that the CAPM is untestable). To the extent testable, the CAPM has been rejected. See Fama & French, *supra* note 9. Another model with reasonably precise predictions about asset price behavior is the elegant Consumption-CAPM. See Douglas Breeden, *An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities*, 7 J. Fin. Econ. 265 (1979). The Consumption-CAPM has been rejected as well. See Lars Peter Hansen & Kenneth J. Singleton, *Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models*, 50 *Econometrica* 1269 (1982). Refutation of expected rate of return models might also be due to the type of equilibrium that economists impose within these models. Traditional asset pricing models rely heavily on “rational expectations” assumptions. In such models, investors are assumed to have essentially complete knowledge of the fundamental structure of their economy and to be completely rational information processors who make optimal statistical decisions. See, e.g., Benjamin M. Friedman, *Optimal Expectations and the Extreme Information Assumptions of ‘Rational Expectations’ Macromodels*, 5 J. Monetary Econ. 23, 38 (1979).
- 39 See, e.g., Eugene F. Fama, *supra* note 24, at 1581 (“In short, a ubiquitous problem in time-series tests of market efficiency, with no clear solution, is that irrational bubbles in stock prices are indistinguishable from rational time-varying expected returns.”).
- 40 See Fama, *supra* note 24, at 1576.
- 41 In the philosophy of science, this is known as the Duhem-Quine Thesis. For a presentation of these two theses and related discussion, see Martin Curd & J.A. Cover, *Philosophy of Science: The Central Issues* 257-301 (1998). See also Rod Cross, *The Duhem-Quine Thesis, Lakatos and the Appraisal of Theories in Macroeconomics*, 92 *Econ. J.* 320 (1982) (arguing that many of the debates in macroeconomics have incorrectly centered on tests of “single target hypotheses” overlooking the fact that the latter are tested with a set of additional auxiliary hypotheses).
- 42 See Fama, *supra* note 24.
- 43 For some examples of long event studies, see Tim Loughran and Jay R. Ritter, *The New Issues Puzzle*, 50 J. Fin. 23 (1995) (providing evidence consistent with the hypothesis that companies issue equity when it is overvalued thus leading to subsequent returns that are abnormally low in the following five years); Roni Michaely, Richard H. Thaler, & Kent L. Womack, *Price Reactions to Dividend Omissions: Overreaction or Drift?*, 50 J. Fin. 573 (1995) (finding that the share prices of firms that initiate (omit) dividend tend to perform abnormally well (poorly) in the three years following the dividend change).
- 44 See Fama, *supra* note 12, at 285.
- 45 See, e.g., Alon Brav & Paul Gompers, *Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies*, 52 J. Fin. 1791 (1997) (arguing that long run returns to firms conducting initial public offerings are insignificantly different from returns on benchmark portfolios of non-issuing firms matched on the firm characteristics market capitalization and book-to-market ratio).
- 46 See Fama, *supra* note 12, at 285.

- 47 Fama also claims that long run patterns of overreaction and underreaction are consistent with chance. He writes: “Consistent with the market efficiency hypothesis that the anomalies are chance results, apparent overreaction to information is about as common as underreaction. And post-event continuation of pre-event abnormal returns is about as frequent as post-event reversal.” Fama, *supra* note 12, at 304. That argument, while convincing to some, is less serious than his other concern with the joint hypothesis problem in long run event studies. See Burton G. Malkiel, *Are Markets Efficient? Yes, Even if They Make Errors*, *Wall St. J.*, Dec. 28, 2000, at A10 (“Moreover, findings of underreaction appear in the data about as frequently as overreaction and so could be random occurrences consistent with market efficiency. Many supposedly exploitable price patterns tend to become marginal or even disappear when alternative measurement approaches are used.”). The problem with the “chance” argument is that overreaction and underreaction seem to occur for systematically different kinds of firms. See Brav & Heaton, *supra* note 14, at 585 (describing differences between firms that exhibit overreaction and firms that exhibit underreaction).
- 48 See Stephen Ross, *Arbitrage Theory of Capital Asset Pricing*, 13 *J. Econ. Theory* 341 (1976).
- 49 See Robert C. Merton, *An Intertemporal Capital Asset Pricing Model*, 41 *Econometrica* 867 (1973).
- 50 See Eugene F. Fama, *Determining the Number of Priced State Variables in the ICAPM*, 33 *J. Fin. & Quan. Analysis* 217 (1998).
- 51 See John D. Lyon, Brad M. Barber, & Chih-Ling Tsai, *Improved Methods for Tests of Long-Run Abnormal Stock Returns*, 54 *J. Fin.* 165, 167 (1999) (“In short, the rejection of the null hypothesis in tests of long-run abnormal returns is not a sufficient condition to reject the theoretical framework of market efficiency.”).
- 52 See Fama, *supra* note 24, at 1602.
- 53 Classic references are Eugene F. Fama, Lawrence Fisher, Michael Jensen, & Richard Roll, *The Adjustment of Stock Prices to New Information*, 10 *Int’l Econ. Rev.* 1 (1969); Stephen Brown & Jerold Warner, *Measuring Security Price Performance*, 8 *J. Fin. Econ.* 205 (1980); and Stephen Brown & Jerold Warner, *Using Daily Returns: The Case of Event Studies*, 14 *J. Fin. Econ.* 14 (1985).
- 54 Differences in predicted returns from different asset pricing models become large over longer time horizons. This is the reason why long run event study evidence is viewed with such suspicion. Large return differences generated over longer horizons mean that different benchmarks can cause long run event studies to reject the null of market efficiency even when prices are efficient. The inability to distinguish between rejections of market efficiency caused by incorrect benchmarks and rejections of market efficiency caused by actual inefficiency is the joint hypothesis problem described above. Of course, only rejections of the latter type are valid.
- 55 See Brad M. Barber & John D. Lyon, *Detecting Long-Run Abnormal Stock Returns: The Empirical Power and Specification of Test Statistics*, 43 *J. Fin. Econ.* 341 (1997). The authors examine a number of test statistics that all rely on a range of asset pricing model specifications. They report simulation results in which they compute the frequency that any of these statistics will reject the market efficiency hypothesis where the researchers have intentionally induced constant drift in the simulated firm returns. They find that induced errors in expected returns are only infrequently detected. For example, when they simulate 1,000 random samples of 200 event firms, each with an annual expected return error equal to 5% per year, they fail to detect the errors 80% of the time. Lower magnitudes of error are detected at even lower frequency. These results give Professor Summers’ warnings some serious “bite,” despite the fact that his cautions have been ignored in the event study literature.
- 56 That so many have ignored Professor Summers’ warning for so long may be due to the fact that he addressed the implications of his more general arguments for event studies in only one paragraph of his important paper. See Summers, *supra* note 16, at 596.

- 57 Short run event studies are typically implemented by subtracting the realized return on the benchmark rather than its expectation. While expected benchmark returns are negligible, the benchmark realization can clearly differ from zero. In large samples, however, the average of unexpected benchmark news will tend to the population mean which is close to zero.
- 58 See, for example, recent papers by Lubos Pastor & Robert F. Stambaugh, *Costs of Equity Capital and Model Mispricing*, 54 J. Fin. 67 (1999), and Lubos Pastor, *Portfolio Selection and Asset Pricing Models*, 55 J. Fin. 179 (2000). In both papers, the authors allow for the possibility of mispricing and then show its effect on measures of cost of equity capital and portfolio allocation.
- 59 Using the Gordon model, we can consider only those cases in which investors' incorrect expected rates of return are higher than the growth rate in dividends. The sensitivity of AR with respect to expected return changes (as provided in equation (3)) suggests that, as with the sensitivity of bonds prices with respect to interest rate changes, AR sensitivity is a convex function of expected return. While it is impossible to evaluate here the many other possible evolutions of a firm's expected payouts, we can provide intuition as to those events that are more susceptible to abnormal return mismeasurement. In the general case let P_t^{-1} and P_t denote the derivatives of the pre- and post- event prices with respect to the expected return, r . The percentage error in the abnormal return AR is then given by:

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

.It is apparent that the sensitivity of event-day abnormal returns is driven by the magnitude of the abnormal return and, more importantly, the term in the square brackets, which is the difference in the pre and post event equity duration. As a result, events that lead investors to alter the timing of firm payouts, and therefore alter the equity duration, are prime candidates for the kind of errors that we analyze.

- 60 Even random errors across event firms may not cancel out. This is due to the fact that abnormal return, AR, is a convex function of expected return, r . Hence, its expected value (when abnormal returns are averaged across a sample of event firms) will be biased upwards.
- 61 See Barber & Lyon, *supra* note 54.
- 62 See Robert J. Shiller, *Irrational Exuberance* (2000).
- 63 The classic argument is probably that found in Milton Friedman, *The Case for Flexible Exchange Rates*, in *Essays in Positive Economics* (1953).
- 64 See, e.g., Shleifer & Vishny, *supra* note 14.
- 65 Efficiency and inefficiency proponents seem to disagree only as to whether there are “limits” to arbitrage that may allow market inefficiency to survive when it arises and is identified by arbitrageurs.
- 66 Indeed, financial economists have been generally unable to identify any reliably “smart” investors. Oddly, advocates of market efficiency who place great faith in the power of arbitrage also embrace evidence that money managers seem unable to beat the market. While not necessarily inconsistent, the absence of identifiable risk adjusted gains to active money management is hardly unambiguous evidence of an active and successful arbitrage process. Indeed, one of the most puzzling results on money management, from the perspective of market efficiency, is how it is even possible for so many money managers to consistently underperform the market. Underperforming the market should be hard to do in an efficient market. See Josef Lakonishok, Andrei Shleifer, & Robert W. Vishny, *The Structure and Performance of the Money Management Industry*, in *1992 Brookings Papers on Economic Activity: Microeconomics* 339 (1992) (exploring the persistent underperformance of the institutional money management industry).

- 67 Again, we are talking here about models of absolute values, not relative values such as are used in sophisticated derivatives pricing models. Relative pricing models can be extraordinarily sophisticated in practice.
- 68 See Paul Asquith, Michael M. Mikhail, & Andrea Au, Information Content of Equity analyst reports (Duke University, Fuqua School of Business, Working Paper).
- 69 See *id.* at Table 1, Panel A.
- 70 See Value Line, *Methods of Evaluating Common Stocks Building and Maintaining Portfolio* (1979).
- 71 Also, real world arbitrage is far riskier than many academics assume. It can be hard to identify even relative value mispricing, and hard to keep capital committed to arbitrage once mispricing is identified. See, e.g., Mark Mitchell, Todd Pulvino, & Erik Stafford, Limited Arbitrage in Equity Markets, 57 J. Fin. 551 (2002).
- 72 485 U.S. 224 (1988).
- 73 In *Basic*, the court states:
- The fraud on the market theory is based on the hypothesis that, in an open and developed securities market, the price of a company's stock is determined by the available material information regarding the company and its business Misleading statements will therefore defraud purchasers of stock even if the purchasers do not directly rely on the misstatements The causal connections between the defendants' fraud and the plaintiffs' purchase of stock in such a case is no less significant than in a case of direct reliance on misrepresentations.
- Basic*, 485 U.S. at 241-42 (citation omitted).
- 74 See, e.g., *Cammer v. Bloom*, 711 F. Supp. 1264, 1293 (D. N.J. 1989) (plaintiffs made prima facie case for market efficiency); *Serfaty v. Int'l Automated Sys., Inc.*, 180 F.R.D. 418, 423 (D. Utah 1998) (market for stock was inefficient).
- 75 See Geoffrey Christopher Rapp, *Proving Markets Inefficient: The Variability of Federal Court Decisions On Market Efficiency in Cammer v. Bloom and Its Progeny*, 10 U. Miami Bus. L. Rev. 303 (2002).
- 76 See, e.g., Brad M. Barber, Paul A. Griffin, & Baruch Lev, *The Fraud-on-the-Market Theory and the Indicators of Common Stocks' Efficiency*, 19 J. Corp. L. 285 (1994) (claiming to “find two such factors that systematically differentiate between efficiently and inefficiently priced stocks, namely, the volume of trade and the number of analysts following the security”); Victor L. Bernard, Christine Botosan, & Gregory D. Phillips, *Challenges to the Efficient Market Hypothesis: Limits to the Applicability of Fraud-on-the-Market Theory*, 73 Neb. L. Rev. 781, 805 (1994) (recognizing that “it is inherently difficult to draw a line between efficiently and inefficiently traded stocks” but claiming to distinguish between empirically supported and unsupported factors as indicators of market efficiency).
- 77 *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993) (reciting list of non-exclusive factors by which to judge the admissibility of scientific expert testimony, including testability, peer review, known or potential rate of error, and general acceptance in the relevant scientific community).
- 78 See Macey, et al., *supra* note 30.

- 79 See, e.g., *In re Executive Telecard, Ltd. Sec. Litig.*, 979 F. Supp. 1021, 1027 (S.D.N.Y. 1997) (“The Expert Witness’ failure to conduct a thorough ‘event study’ would be reason enough to exclude his proposed testimony.”)
- 80 See, e.g., Sanjai Bhagat & Roberta Romano, *Event Studies and the Law: Part II: Empirical Studies of Corporate Law*, 4 Am. L. & Econ. Rev. 380 (2002).
- 81 See David I. Tabak & Frederick C. Dunbar, *Materiality and Magnitude: Event Studies in the Courtroom*, in *Litigation Services Handbook: The Role of the Financial Expert* ch. 19 (Roman L. Weil, et al., eds., 3d Ed. 2001) (advocating possible use of the event study methodology for general measurement of corporate damages). At least one court has expressed a hostile view of event study evidence outside of the securities litigation context. See *LaSalle Talman Bank, F.S.B. v. United States*, 45 Fed. Cl. 64, 82 (1999) (“Although the stock market’s valuation of a company may have more relevance to calculating damages than reading entrails, the court is unwilling to concede more.”).
- 82 See, e.g., Sanjai Bhagat & Roberta Romano, *Event Studies and the Law: Part I: Technique and Corporate Litigation*, 4 Am. L. & Econ. Rev. 141, 142 (2002) (“As evidence accumulated that the stock market was efficient, the methodology came to be used instead to value the event under study.”) (emphasis added).
- 83 Perhaps the most famous example of judicial skepticism of efficient markets thinking in the corporate control context appears in *Paramount Communications, Inc. v. Time, Inc.*, 1989 Del. Ch. LEXIS 77, at *55-56 (July 17, 1989) (rejecting efficient markets view that directors could not know more than the market about long term valuation) (Allen, C.).
- 84 See, e.g., Richard S. Ruback & Michael C. Jensen, *The Market for Corporate Control: The Scientific Evidence*, 11 J.Fin. Econ. 5, 9 (1983) (“Numerous studies estimate the effects of takeovers on stock prices of bidder and target firms around the time of announcement of takeover attempts. Such ‘event studies’ use estimates of the abnormal stock price changes around the offer announcement date as a measure of the economic effects of the takeover.”); see also Stephen J. Brown & Jerold B. Warner, *Measuring Security Price Performance*, 8 J. Fin. Econ. 205, 205 (1980) (“In addition, to the extent that the event is unanticipated, the magnitude of abnormal performance at the time the event actually occurs is a measure of the impact of that type of event on the wealth of the firms’ claimholders.”).
- 85 See Eugene F. Fama & Merton H. Miller, *The Theory of Finance* 335 (1972), arguing that in a perfect market:
- at any point in time market prices of securities provide accurate signals for resource allocation; that is, firms can make production-investment decisions, and consumers can choose among the securities that represent ownership of firms’ activities under the presumption that security prices at any time “fully reflect” all available information. A market in which prices fully reflect available information is called efficient.
- Id. The link between informational efficiency of prices and economic efficiency is more tenuous once market imperfections are introduced. See James Dow & Gary Gorton, *Stock Market Efficiency and Economic Efficiency: Is There a Connection?*, 52 J. Fin. 1087, 1087-1129 (1997) (arguing that outside investors do not have a direct role in allocation of equity capital. Instead, managers do. In this case, investors attempt to give managers the right incentives through market prices. The authors show that in such an economy information efficiency is not a sufficient condition for economic efficiency).
- 86 Theresa A. Gabaldon, *John Law, with a Tulip, in the South Seas: Gambling and the Regulation of Euphoric Market Transactions*, 26 J. Corp. L. 225 (2001).
- 87 The consequences of being wrong may be severe. If rational investment opportunities are constrained because they are misidentified as “euphoric market transactions,” then serious social losses might result. Indeed, such regulation may prove harmful even if markets are indeed inefficient with respect to euphoric market transactions. See Andrei Shleifer, *Are Markets Efficient? No, Arbitrage Is*

Inherently Risky, Wall St. J., Dec. 28, 2000, at A10 (arguing that socially beneficial internet boom would not have occurred on the observed large scale without financing from what he perceives as irrationally exuberant investors).

- 88 See Lynn A. Stout, *Are Stock Markets Costly Casinos? Disagreement, Market Failure, and Securities Regulation*, 81 Va. L. Rev. 611 (1995) (presenting a theory of excessive trading that results from rational disagreement); Paul G. Mahoney, *Commentary: Is there a Cure for Excessive Trading?*, 81 Va. L. Rev. 713 (1995) (arguing that Stout's model of rational disagreement is actually a model of irrational investor behavior); Lynn A. Stout, *Reply: Agreeing to Disagree Over Excessive Trading*, 81 Va. L. Rev. 751 (1995) (explaining the difficulty of distinguishing rational and irrational disagreement). Similarly, market indeterminacy raises troubling questions about many other policy decisions, such as whether social security funds should be invested in stock market investments.
- 89 Market indeterminacy research might build on Austrian or Neoaustrian views of financial markets that question the very existence of the types of equilibrium behavior posited in neoclassical economics. For one recent application of such thinking in a market efficiency context, see Harald Benink & Peter Bossaerts, *An Exploration of Neo-Austrian Theory Applied to Financial Markets*, 56 J. Fin. 1011 (2001) (applying neoaustrian economic methodology to the study of financial markets). Market indeterminacy is, in some sense, an application of Knightian ideas of unmodelable “uncertainty” versus modelable “risk.” See Frank H. Knight, *Risk Uncertainty and Profit* (2002).
- 90 Relative pricing, rather than absolute pricing, appears to drive much real world arbitrage activity. Real world investors seem to believe in the power of relative pricing and view it as distinct from the problem of absolute, or fundamental, valuation. See, e.g., Leon Levy, *The Mind of Wall Street* 52 (2002). Levy states:
- Those who believe in an efficient market, and I am not one of them, believe that stocks can never be underpriced or markets overvalued. They say you can't beat an efficient market - all you need to do is put your money into an index fund. The problem is that all the stocks may be reasonably priced compared to one another, but the whole market may be too high or too low.
- Id.
- 91 See Edward M. Miller, *Risk, Uncertainty, and Divergence of Opinion*, 32 J. Fin. 1151, 1151-68 (1977) (arguing that divergence of opinion, that is, heterogeneity in investors' expectations, coupled with short sales constraints yield predictions regarding rates of return that differ from the standard CAPM. For example, if high risk securities are also hard to short sell then, in equilibrium these securities might be held by the most optimistic investors and thus earn low rates of return in the future). See also Stephen Morris, *Speculative Investor Behavior and Learning*, 111 Q. J. Econ. 1111, 1111-34 (1996) (presenting a model where investors hold different Bayesian prior beliefs about an asset's dividends. The investors rationally consider the possibility that they might be able to resell the asset to another optimistic investor. This eventually leads to the patterns of underperformance associated with initial public offerings). The feasibility of short-selling and the associated costs of borrowing are an empirical matter. For recent evidence see Christopher C. Geczy, David K. Musto, & Adam V. Reed, *Stocks Are Special Too: An Analysis of the Equity Lending Market*, 66 J. Fin. Econ. 241, 241-69 (2002).
- 92 Market indeterminacy also provides an important rationale for the existence of risk premia for assets in which indeterminacy is likely to exist. Investors might find it valuable to hold hedging products that insure exposure to the level and changes in indeterminacy such as in housing markets, human capital, and other important asset markets that are subject to hard to quantify economic risks. On the problem of hedging these and other risks, see Robert J. Shiller, *The New Financial Order: Risk in the Twenty-First Century* (2003).
- 93 Or maybe not. Unfortunately, researchers face indeterminacy as well.