# Market Efficiency after the Financial Crisis: It's Still a Matter of Information Costs

# MARKET EFFICIENCY AFTER THE FINANCIAL CRISIS: IT'S STILL A MATTER OF INFORMATION COSTS

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## INTRODUCTION

CONTRARY to the views of many commentators, the Efficient Capital Market Hypothesis ("ECMH"), as originally framed in financial economics, was not "disproven" by the Subprime Crisis of 2007–2008, nor has it been shown to be irrelevant to the project of regulatory reform of financial markets. To the contrary, the ECMH points to commonsense reforms in the wake of the Crisis, some of which have already been adopted. The Crisis created a lot of losers—from individual investors to pension funds and German *Landesbanken*—who purchased mortgage-backed securities that they did not, and perhaps could not, understand, and it cost them extraordinary amounts of money as a result. Perhaps more significantly, the knock-on effects of the Subprime Crisis rippled through the finance markets, pushed Lehman Brothers over the edge, decimated other financial institutions across the world, and resulted in massive provisions of government assistance and sometimes the full nationalization or failure of financial institutions and even giant industrial enterprises such as General Motors and Chrysler. Moreover, the damaging consequences of the Subprime Crisis continue. America's recovery is fragile. The Great Recession of 2008–2010 is also the backdrop for Europe's sovereign debt and banking crisis that still lingers today. Some smaller European nations—including Greece, Iceland, Ireland, and Portugal—required large international aid packages, and even larger countries such as Italy and Spain were at risk of default prior to decisive intervention by the European Central Bank. The resulting pressure to slash government spending threatens political stability across Europe. The recent political *Sturm und Drang* in the United States over budget deficits and debt limits reflects similar sharply divided views about the causes and policy implication of the Crisis.

Against this backdrop, one might think it of small consequence that the Subprime Crisis is also said to have dealt major setbacks to academic theories, most particularly the ECMH.[1] After all, the only loss that fol-

[1] Macroeconomic theory has also suffered a reputation loss. As Robert Hall has pointed out, neoclassical macroeconomics does not explain why drops in output and employment persist for significant periods after a financial crisis is resolved. Robert E. Hall, Why Does the Economy Fall to Pieces after a Financial Crisis?, 24 J. Econ. Persp. 3, 7 (2010). Hall argues that the persistence is caused by an increase in financial frictions, particularly information costs, which survive for significant periods after the immediate crisis is resolved. Id.; Robert E. Hall, The High Sensitivity of Economic Activity to Financial Frictions, 121 Econ. J. 351, 351, 353 (2011). As we develop in Part III, a similar phenomenon exists with respect

lows a crisis in theory—as opposed to a debilitating crisis in the economy—is damage to the egos of the academics who defend or reject a contested theory. Indeed, academic theories (unlike economies) thrive on contradiction to make advances, a point famously stressed by Thomas Kuhn almost fifty years ago.[2]

Nevertheless, the particular iteration of theory and response attending the ECMH after the Subprime Crisis differs importantly from other encounters between theory and seemingly inconvenient facts. The reason is that the ECMH had moved beyond the academic community beginning in the 1970s, and has played a prominent role in the larger world political debate and regulatory reform ever since. One or another interpretation of the ECMH has influenced regulatory policy for well over thirty years.[3] As a result, the public understanding of the limits of the ECMH is not just a matter of academic debate; it carries real political consequences. Important regulatory implications follow if the ECMH itself is held partially responsible for the Subprime Crisis.[4]

Thus, the rise and fall of the ECMH is as much a political story as a story about a contested academic theory. A theory that enters the realm of politics is inevitably refashioned by political actors to serve political ends. The ECMH was hijacked by a powerful political clientele during the Reagan era, if not before, and was transformed, at least in the eyes of the public, from a narrow but important academic theory about the in-

to market efficiency. Edward G. Fox, Merritt B. Fox, and Ronald J. Gilson argue that crisis-related changes in information costs also explain another financial crisis-related phenomenon: the increase in unsystematic risk in stock prices that has accompanied every financial crisis since the early twentieth century. Edward G. Fox, Merritt B. Fox & Ronald J. Gilson, Economic Crisis and Share Price Unpredictability: Reasons and Implications 1–8 (Columbia Law Sch. Ctr. For Law & Econ. Studies, Working Paper No. 468, 2014), available at http://ssrn.com/abstract=2401712.

[2] Thomas S. Kuhn, The Structure of Scientific Revolutions 6 (1962).

[3] These range from Securities and Exchange Commission ("SEC") rules allowing corporations to incorporate by reference information contained in already-filed documents into short form registration statements, to the U.S. Supreme Court's decision in *Basic Inc. v. Levinson*, 485 U.S. 224, 247 (1988), which by allowing reliance to be presumed in a securities fraud class action if the plaintiffs show that the relevant market was efficient, provides the doctrinal foundation that makes securities class actions economically feasible. See infra note 5.

[4] See, e,g., George A. Akerlof & Robert J. Shiller, Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism 1–3 (2009); John Cassidy, How Markets Fail: The Logic of Economic Calamities 3–14 (2009); Justin Fox, The Myth of the Rational Market: A History of Risk, Reward, and Delusion on Wall Street xi–xvi (2009); Dan Awrey, Complexity, Innovation and the Regulation of Modern Financial Markets 1–6 (Sept. 1, 2011) (unpublished manuscript), available at http://ssrn.com/abstract=1916649.

formational underpinnings of market prices into a broad ideological justification for preferring market outcomes over regulation. In this sense, the ECMH was itself the subject of an artificial bubble. It was inflated to provide a scientific justification for claims about the accuracy and meaning of market prices that were much more far-reaching than it could support. Now that these claims no longer seem plausible, the bubble has burst and the credibility of the ECMH has plummeted. The danger today, in our view, is that academics and regulators may overreact to the prior overstatement of the implications of the ECMH by deregulatory partisans, and in so doing overlook the valuable policy insights that an appropriately "sized" ECMH can provide.[5] It follows that the ECMH must be returned to its original dimensions to preserve its narrower, but still important, intellectual value for regulators and policymakers.

In Part I, we explain how the slippery notion of "fundamental efficiency" first inflated the ECMH into a brief for the broad deregulation of the markets and now is deployed by critics to demonstrate that the ECMH is empirically and theoretically wrong. In the first case, the ECMH was badly overstated by assuming the convergence of informa-

[5] The continuing status of the fraud-on-the-market doctrine under *Basic* is a good example. That doctrine makes a securities fraud class action economically feasible by dispensing with individual proof of reliance where the security in question is traded in an efficient market. See, e.g., *Basic*, 485 U.S. at 247. The idea is that an efficient market incorporates a misstatement or omission into the security's price, and traders can be presumed to rely on that price. Proof of an efficient market is therefore a condition to the certification of a plaintiff's class. See, e.g., id. A fair reading of the opinions in *Amgen, Inc. v. Connecticut Retirement Plans & Trust Funds*, 133 S. Ct. 1184, 1196–97 (2013), decided after the Subprime Crisis and holding that a plaintiff was not required to prove the materiality of a misstatement or omission at the time of class certification, is that there are four votes to grant certiorari to reconsider *Basic*. It is also a fair concern that at least part of the motivation is a misunderstanding of market efficiency. See id. at 1204 (Alito, J., concurring) ("I join the opinion of the Court with the understanding that the petitioners did not ask us to revisit *Basic*'s fraud-on-the-market presumption. As the dissent observes, 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." (internal citations omitted)); id. at 1206 (Scalia, J., dissenting) ("Today's holding does not merely accept what some consider the regrettable consequences of the four-Justice opinion in *Basic* . . . ."); id. at 1208 n.4 (Thomas, J., dissenting) ("The *Basic* decision is itself questionable. . . . [T]he Court has not been asked to revisit *Basic*'s fraud-on-the-market presumption. I thus limit my dissent to demonstrating that the Court is not following *Basic*'s dictates. Moreover, the Court acknowledges there is disagreement as to whether market efficiency is a binary, yes or no question, or instead operates differently depending on the information at issue . . . ." (internal quotation marks omitted)). Not surprisingly, the Court has now granted certiorari with respect to the question of whether *Basic* should be overruled. Erica P. John Fund v. Halliburton Co., 718 F.3d 423 (5th Cir. 2013), cert. granted, 134 S. Ct. 636 (2013).

tional and fundamental efficiency; in the second, the ECMH is badly understated by the claim that the potential divergence between informational and fundamental efficiency deprives the ECMH of any significance for regulatory policy. As we describe below, fundamental efficiency means that investors get the correct price when they purchase securities in competitive financial markets—the discounted present value of expected cash flows associated with a security. Informational efficiency means only that stock prices respond quickly to the release of new public information. The difference is inherent in testing whether an efficient market price is also fundamentally efficient. In perfect markets—ones in which all information relevant to determining a security's fundamental value is publicly available and the mechanisms by which that information comes to be reflected in the securities market price operate without friction—fundamental and informational efficiency coincide.[6] But where all value-relevant information is not publicly available and/or the mechanisms of market efficiency operate with frictions, the coincidence is an empirical question both as to the informational efficiency of prices and their relation to fundamental value. Answering that empirical question thus requires a yardstick—an observable measure of fundamental value against which the market price can be compared. And here the problem arises—market prices are observable and fundamental value is not.

We argue in this Article that informational efficiency and fundamental efficiency are related: Even if we cannot observe fundamental efficiency, we can with confidence predict that making prices more informationally efficient will move them in the direction of fundamental efficiency. But there is no single yardstick of fundamental value against which market prices can be compared. This point is made most clearly by reference to a famous quip by American comedian Henny Young-

[6] Despite the availability of all value-relevant information and the frictionless operation of the mechanisms that cause that information to be reflected in securities prices, one can still imagine that prices will not be fundamentally efficient. This would be because the market applies the wrong asset-pricing model to that information as a result of behavioral biases. See Econ. Sci. Prize Comm. of the Royal Swedish Acad. of Sci., Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 31 (2013) [hereinafter Nobel Prize Committee Report], available at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/advanced-economicsciences2013.pdf (surveying behavior explanations for asset pricing). Note, however, that there may be no clear line between a market that employs the wrong model and an observer's misunderstanding of what investors do value—that is, the market model may be right and we simply fail to understand investors' utility function.

man. When asked by an acquaintance, "How's your wife?" Youngman replied without hesitation, "Compared to what?"[7] In the end, the regulatory choice always comes down to comparing the accuracy of the market's valuation at a point in time with another yardstick of fundamental value calculated at the *same* moment in time. Nevertheless, we argue throughout this Article, and most conspicuously in Part I, that informationally efficient market prices are related to fundamental value through the availability of value-relevant information and market mechanisms that cause that information to be reflected in security prices. For policy purposes, increasing informational efficiency pushes market prices in the direction of fundamental value, even if fundamental value is not observable, and so supports the policy agenda we set out in Part IV. (Indeed, we believe this to be a consensus view among prominent critics of the ECMH even if it is seldom stated.[8])

Part II locates the ECMH historically as the common element in the foundational theories of modern finance and briefly reprises our own prior efforts to assess the effects of market frictions on informational efficiency. The foundational theories of financial economics—including the Miller-Modigliani Irrelevance Propositions and the Capital Asset Pricing Model—are rooted in the assumption that nothing matters in perfect markets because costless arbitrage eliminates mispricing and penalizes bad financial strategies. A perfect market is one in which prices are fundamentally and informationally efficient. But such a market is just a helpful construct, a useful platform from which to begin the investigation of real markets with numerous frictions (or imperfections) ranging from imperfect information to agency costs and defective market structures. Investigation of how these frictions affect securities prices has generated a vast literature in financial economics and a smaller but still considerable legal literature devoted to market regulation. Our particular contribution to this literature has been to show that the informational efficiency of market prices must be understood as relative rather than absolute, that is, that prices respond to new information more or less rapid-

[7] Gregory Bateson & Henny Youngman, The Review of Arts, Literature, Philosophy, and the Humanities, http://www.ralphmag.org/FI/why.html (last visited Nov. 16, 2013).

[8] See, e.g., Gene D'Avolio, Efi Gildor & Andrei Shleifer, Technology, Information Production, and Market Efficiency 1, 17, 30 (Harvard Inst. of Econ. Research, Working Paper No. 1929, 2001), available at http://ssrn.com/abstract=286597 (advocating strong efforts to increase the informational efficiency of market prices even though the authors are market efficiency skeptics).

ly rather than instantly or not at all. The speed with which prices reflect a particular "bit" of new information depends on the cost characteristics of the information and the transaction costs of trading on it. Therefore, the ECMH should be understood as a theory about the relative informational efficiency of market prices, which is inherently a context-specific inquiry.[9]

Part III of this Article assesses the Subprime Crisis in light of a properly framed ECMH—that is, one that conceives of the market's relative informational efficiency as a function of the level of market frictions with respect to both the availability of value-relevant information and the mechanisms through which that information is reflected in prices. We stress here that information of great relevance to pricing some of the instruments associated with the Subprime Crisis was very costly—too costly, in fact, to enter into the pricing of these instruments. In addition, market structure generally made trading on information about these securities costly or impossible (because over most of the relevant period there was no secondary market at all). In such a setting, the ECMH predicts that markets will be relatively less efficient, as in fact they were. We also review explanations of a less technical matter: Why did sophisticated investors purchase these instruments of limited liquidity that they could not price? Of the various explanations to be found in the Crisis literature, we argue that the most persuasive are those that turn on rational but wrong beliefs about the U.S. residential housing market (that is, high information costs for all market participants including the regulators) and the poorly-aligned incentives of key market intermediaries, including the major investment banks and the rating agencies. Alternative explanations that invoke "cognitive bias" to explain the behavior of institutional investors and, hence, the divergence between observed and fundamental value, are less persuasive.[10]

[9] Thus, in our view, *Basic* has always been wrong in framing the standard for a presumption of reliance as whether the market was efficient. Market efficiency is a continuum, not a single condition. See Ronald J. Gilson & Reinier Kraakman, The Mechanisms of Market Efficiency, 70 Va. L. Rev. 549, 554–61 (1984). As a result, the proper standard for the presumption is whether a misstatement affected the price of the stock at issue. For an argument that the Supreme Court should adopt this position in its reconsideration of *Basic*, see Lucian A. Bebchuk & Allen Ferrell, Rethinking *Basic* 19 (John M. Olin Ctr. for Law, Econ., & Bus., Harvard Law Sch., Discussion Paper No. 756, 2013), available at http://ssrn.com/abstract=2371304.

[10] Psychology may play a much larger role in assessing the behavior of homebuyers in the subprime and alt-prime markets. See, e.g., Oren Bar-Gill, The Law, Economics and Psychology of Subprime Mortgage Contracts, 94 Cornell L. Rev. 1073, 1119 (2009). However,

Finally, we turn in Part IV to an assessment of whether an appropriately sized ECMH has policy lessons for regulators in a post-Crisis world. As noted above, we argue throughout this Article that while the informational efficiency of prices is related to the fundamental values of securities, the ECMH standing alone cannot definitively determine whether securities are mispriced relative to their fundamental value because fundamental value is not observable.[11] However, making prices more informationally efficient will move them in the direction of fundamental efficiency. In this Part, we illustrate how regulators can use the ECMH to enhance the informational efficiency of prices and thereby push prices toward the theoretical (and aspirational) fundamental value. More informationally efficient market prices can also better inform regulators. There is reason to believe, for example, that the Federal Reserve had no better information concerning the instruments underlying mortgage-backed securities and derivatives than did the market.[12] If so, more informed market prices might have allowed for more calibrated and more prompt regulatory intervention. Alternatively, prices that fail to respond to low-cost, value-relevant information raise a red flag. The reason may be thin trading or a flawed market structure, but it may also be that public-sector agency costs impede or distort market activity.[13] Thus, attention to the extent to which market prices are informationally efficient should be viewed as a complement to effective regulation, not as a substitute.

We address several kinds of regulatory intervention that can increase informational efficiency and enhance transparency, ranging from the obvious step of enhancing disclosure, to the introduction of stress testing for financial institutions, and to direct intervention in shaping the market for novel securities such as the collateralized debt obligations ("CDOs") and residential mortgage-backed securities ("RMBSs"). Our intention is

the less likely it is that a borrower would be able to make her mortgage payments after the teaser rates expired on a no-down-payment loan, the more rational a borrower's strategy to live in the house to be financed at a greatly subsidized cost for the term of the teaser rate.

[11] Luigi Zingales frames the point nicely: "[T]his implication of the [ECMH] is not a good theory in the Popperian sense (after philosopher Karl Popper) because it is almost impossible to reject." Luigi Zingales, Learning to Live with Not-So-Efficient Markets, 139 J. Am. Acad. Arts & Sci. 31, 36 (2010).

[12] See infra note 93 and accompanying text.

[13] By "public sector agency costs," we mean the response of regulators to political pressure. One example is the misaligned incentives of a regulator who must decide whether to dampen trading in a market from which institutions with powerful lobbies are profiting.

less to make specific reform proposals—indeed, some reforms we address have already been adopted—than it is to demonstrate how the ECMH can usefully inform regulatory reform and, conversely, how some widely-accepted reforms implemented in the wake of the Crisis depend, at least implicitly, on the assumption that there is likely to be a correlation between the informational efficiency of market prices and fundamental value.

## I. "INFORMATIONAL" VERSUS "FUNDAMENTAL" EFFICIENCY

As conventionally understood, a market is informationally efficient if investors cannot make abnormal returns by trading on public information.[14] Note that this definition says nothing about the relationship between informational efficiency and the fundamental value of securities. An informationally efficient price may move closer to fundamental efficiency if the market price would change should non-public information become public, or if frictions associated with the mechanism by which information becomes reflected in price were reduced.

By contrast the fundamental value of a security is conventionally understood to be the true present value of its expected future cash flows as these cash flows are estimated and discounted by the market's valuation model, which is usually presumed to be fixed across markets and assets.[15] It follows that a market is fundamentally efficient if prices accurately track the fundamental values of securities—in colloquial terms, if the market price is right.[16] Defenders of this ambitious notion of funda-

[14] The definition in the text encompasses weak form and semi-strong form efficiency—that is, efficiency with respect to past and current information. Strong-form efficiency, in contrast, requires that the market price also reflect private information—that is, information that is not public at all.

[15] Fox, Fox & Gilson, supra note 1, at 9–22, 27, provides empirical evidence of the impact of idiosyncratic risk on an increase in uncertainty concerning the market's valuation model.

[16] Fundamental efficiency, thus, is quite different from strong form efficiency; the latter posits that private information is reflected in market price; the former claims that the market price is "correct." Judge Easterbrook, who knows better, conflates the two in *Schleicher v. Wendt*, 618 F.3d 679, 685 (7th Cir. 2010). He correctly describes weak form and semi-strong form efficiency as covering historical prices and newly released information, but then states that "[t]he strong version adds a claim that the price set in this way is *right*, in the sense that it accurately reflects the firm's value." Id. In contrast, the U.S. Court of Appeals for the First Circuit gets it right when the court states what is necessary to trigger the presumption of reliance provided by the fraud-on-the-market doctrine from *Basic Inc. v. Levinson*, 485 U.S. 224 (1988):

mental efficiency concede that perfection is impossible: Market traders can know only public information, not the private information of corporate managers or the contingent outcomes of future events. But this "good enough" fundamental efficiency is often the standard by which the ECMH has been judged in the wake of the Subprime Crisis. And even "good enough" fundamental efficiency raises an awkward question: How do traders know the model that should be applied in discounting future cash flows? And for that matter, how do the critics who assert that the ECMH is discredited because it fails the "good enough" criterion of market efficiency know the market's valuation model so they can compare the market price to that dictated by the valuation model?

As noted above, the empirical problem is the absence of a reference point against which to measure market prices. If the prices of mortgage-backed securities are asserted to have been inefficient before and after the onset of the Subprime Crisis, the obvious riposte is: "As compared to what?" As noted above, even "good enough" fundamental value must be measurable to see if it differs from market price. Yet as Richard Roll pointed out with respect to empirically testing the Capital Asset Pricing Model ("CAPM"),[17] if we cannot measure the price that CAPM dictates because the market portfolio is not observable, we cannot make the price-value comparison either with respect to magnitude or even direction. Put simply, there is nothing against which to measure market price. The best we can do is find a more or less plausible proxy for the market portfolio such as a portfolio of S&P 500 stocks. A finding that market price differs from fundamental value (as measured by CAPM or another

> For purposes of establishing the fraud-on-the-market presumption of reliance, we adopt the prevailing definition of market efficiency, which provides that an efficient market is one in which 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 is known as "informational efficiency." We reject a second and much broader meaning of "fully reflect," known as "fundamental value efficiency," which requires that a market respond to information not only quickly but accurately, such that the market price of a stock reflects its fundamental value.

In re Polymedica Corp. Sec. Litig., 432 F.3d 1, 19 (1st Cir. 2005); see also In re Countrywide Fin. Corp. Sec. Litig., 273 F.R.D. 586, 610 (C.D. Cal. 2009) (citing In re Apple Computer Sec. Litig., 886 F.2d 1109, 1114–15 (9th Cir. 1989)) (affirming that fraud-on-the–market cases are concerned with informational efficiency).

[17] We discuss the Capital Asset Pricing Model infra in this Part and in Part II.

valuation model) is consistent with either an informationally inefficient market or an incorrect pricing model.[18]

Roll's alternative explanations for a discrepancy between a pricing model's prediction (or a prediction of a proxy for a pricing model) and observable market prices, however, have very different implications if market efficiency is used in both its positive and normative senses: We want to know if markets are informationally efficient, and we want some handle on how to make prices fundamentally efficient. The policy goal is to eliminate frictions. Informationally efficient markets can then make it easier to determine whether the pricing model we employ as a proxy for the "true" but unobservable valuation model underlying fundamental value is a reasonable one, or whether, alternatively, market prices seem to be largely random or a function of "animal spirits" rather than meaningful economic valuation.

Now consider the ECMH from the standpoint of a sophisticated critic of both its fundamental efficiency and informational efficiency variants. With respect to fundamental efficiency, no sophisticated critic of the ECMH would claim to know the market's "true" valuation model with certainty. Rather, she would make one of two arguments depending on which form of efficiency was at issue. In the case of fundamental efficiency, she would argue that it is possible to develop more or less plausible proxies for the unobservable "true" model—and that, in fact, such models are developed routinely by investors. These proxy models then can be back-tested in a rough way: The more closely a proxy model's ex ante predictions approach the observable actual present value of the cash payouts from holding securities, the better they are likely to be at replicating the "true" model. Correlatively, if we observe ex post that a given proxy model predicts the ex ante present values of future payouts better than contemporaneous market prices, then these market prices were plausibly inefficient in the fundamental sense (even if they were efficient in the informational sense because arbitrage profits were not possible). The empirical work of the 2013 Nobelist Robert Shiller illustrates

[18] 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, 130 (1977) (testing difficulties arising from an incomplete proxy for market portfolio). This point has become commonplace in the market efficiency debate. See, e.g., Eugene F. Fama, Efficient Capital Markets: A Review of Theory and Empirical Work, 25 J. Fin. 383, 388 (1970); Zingales, supra note 11, at 32 (stating that if we reject the equality of market price and fundamental value, "it is unclear whether that entails rejecting the asset-pricing model that assesses the fundamental value or rejecting the [ECMH]").

this kind of critique of fundamental efficiency (that is, what we term the "inflated" ECMH).[19] Finally, the critic would note that valuation models change. Unpredictable economic crises—the result of Knightian uncertainty, not the resolution of probabilities observable ex ante—result in the erosion of confidence that the pre-crisis valuation model still was valid in the post-crisis world. As a consequence, price volatility will increase as the number of pieces of new information with implications for stock prices increases because a range of different models, with respect to which different information is value-relevant, may turn out to be predictive post-crisis.[20]

A sophisticated critic of the ECMH also would address informational efficiency, which rests at the heart of a modest ECMH. Evaluating the informational efficiency of market prices is important in its own right and because it is a prerequisite for fundamental efficiency. Whatever else may be said about the theoretical construct of fundamental value, it must certainly be true that a security's fundamental value incorporates all available information that bears on the discounted value of its expected future cash flows. Her claim with respect to the informational inefficiency of particular markets would be that the release of public information with obvious negative implications for market prices under *any* reasonable valuation model did not in fact affect these prices, or, still worse, seemed to pressure them in the wrong direction.

In response to this argument, a defender of the ECMH would readily agree that there are circumstances and markets in which price does deviate from any plausible notion of value for reasons that have little to do with information. The classic example is a "fire sale" in which sellers must liquidate their inventories for exogenous reasons, but sufficient buyers can be found only at very low, distorted prices.[21] No one would suggest that the price in such a market is informationally efficient other than in the narrow context of a forced sale. In addition, the federal courts are familiar with thinly traded securities markets that are almost certainly relatively inefficient even with respect to the most inexpensive public

[19] See Nobel Prize Committee Report, supra note 6, for an excellent summary of Shiller's empirical studies, which range from comparing the long-term volatility of share prices and dividends to developing simple models for predicting long-term returns on shareholdings. Professor Shiller was awarded the 2013 Nobel Prize in Economic Science together with Eugene Fama and Lars Peter Hansen. Id.

[20] See Fox, Fox & Gilson, supra note 1, at 23–25, 27–28.

[21] Andrei Shleifer & Robert Vishny, Fire Sales in Finance and Macroeconomics, 25 J. Econ. Persp. 29, 30 (2011).

information. In fraud-on-the-market litigation, courts routinely rule on the informational efficiency of markets in particular securities in determining whether to certify a plaintiffs' class.[22] Not surprisingly, one of the most important legal tests of efficiency is the extent to which the market responds to new information that has obvious implications for a security's value. A market may not respond to such information for the simple reason that trades are few and the security is illiquid as a result.[23] An implicit qualification of the ECMH is that one cannot expect informationally efficient prices without active trading. Finally, there is the issue of primary markets. A security's issuing price precedes its active trading price. It is active trading that aggregates information in price, which is why a claim of price efficiency is weaker all else equal for prices in initial public offerings than for prices in actively traded secondary markets. This point is particularly relevant in analyzing the implications of the Subprime Crisis for the ECMH, as we demonstrate below.

Stepping out of the roles of critic or defender of the ECMH, what should we conclude thus far? First, that direct testing of fundamental efficiency is impossible in theory, but that if we lower our standard of rigor it is possible to use proxy models of various sorts to assess whether it is more or less likely that a market is fundamentally efficient. Second, the informational efficiency of market prices can be tested more easily and with more definitive results. Third, informational efficiency is a precondition for fundamental efficiency, implying that informationally inefficient prices cannot be fundamentally efficient. Our normative point, addressed in Part IV, then follows: Making markets more informational-

[22] See supra note 5 (explaining that the presumption of reliance necessary to certify a class in a securities fraud case is conditional on a finding that the relevant market was informationally efficient).

[23] The standard criteria used by courts to make the assessment of market efficiency in securities class actions are: (1) the trading volume of the security; (2) the number of analysts following the security; (3) the issuer's eligibility to file SEC Form S-3; (4) the presence of market makers in the security; and (5) empirical evidence suggesting a causal connection between new information and price movement. See, e.g., In re Countrywide Fin. Corp. Sec. Litig., 273 F.R.D. 586, 611–12 (C.D. Cal. 2009) (citing Cammer v. Bloom, 711 F. Supp. 1264, 1284, 1286–87 (D.N.J. 1989)). From our perspective, this list combines a direct test of a market's relative efficiency (whether the price moves in response to value-relevant new information) and measures related to the mechanisms by which new information is incorporated into market price—the number of analysts, the characteristics necessary to use Form S-3, and the number of market makers.

ly efficient is also likely to nudge their prices in the direction of fundamental efficiency regardless of valuation models.

## II. THE ORIGINS OF THE ECMH AND THE CONCEPT OF RELATIVE INFORMATIONAL EFFICIENCY

To better illustrate the relationship between market imperfections and the informational efficiency of market prices, we begin with a capsule account of the development of the ECMH.[24] As noted earlier, the assumption of perfect markets underlies the major theoretical developments in financial economics between the late 1950s and the early 1970s, including CAPM[25] and the Miller-Modigliani Irrelevance Propositions.[26] The logic of these theories was compelling in a world of perfect markets—which included, of course, the assumption that market prices reflected all relevant information. The theoretical power of perfectly informed prices easily led to the question whether prices in some real markets might roughly approximate fully informed prices, at least with respect to publicly available information. This conjecture was at the core of an empirical ECMH as this was set out by the recent Nobelist Eugene Fama in a seminal 1970 article reviewing the empirical literature on the efficiency with which public equity prices reflected data from three information sets—past price history, public information, and all information (including private information)—that define the now-famous trichotomy of "weak," "semi-strong," and "strong" form informational efficiency.[27] Financial economists quickly accepted the semi-strong (or public information) form of the ECMH, even to the point of suggesting that it was almost tautological. Commenting on Fama's 1970 article, his contemporary William Sharpe stated: "Simply put, the thesis is this: that in a well-functioning securities market, the prices of [securities] will reflect predictions based on all relevant and available information. This seems to be trivially self-evident to most professional economists—so

[24] We have previously described the conduits through which information enters price in an actively traded market as "the mechanisms of market efficiency." Gilson & Kraakman, supra note 9, at 565–67.

[25] See William F. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, 19 J. Fin. 489, 500–01, 505 (1964).

[26] Merton H. Miller & Franco Modigliani, The Cost of Capital, Corporation Finance and the Theory of Investment, 48 Am. Econ. Rev. 261, 266–67 (1958); Merton H. Miller & Franco Modigliani, Dividend Policy, Growth, and the Valuation of Shares, 34 J. Bus. 411, 411–12 (1961).

[27] See Fama, supra note 18, at 383.

much so, that testing seems rather silly."[28] Ten years later, William Beaver made much the same point: "Why would one ever expect prices *not* to 'fully reflect' publicly available information? Won't market efficiency hold trivially?"[29] Absent frictions, the arbitrage machine should logically ensure that price fully reflects available information.

Despite logic and evidence, however, the institutional question remained: How could real markets seem to reflect public information instantaneously?[30] Why didn't market frictions drive a large wedge between the point at which public information was announced and the point at which it seemed to be fully reflected in actual prices—at least in actively traded public equity markets? Why didn't market frictions—information costs—determine how rapidly most public information seemed to be impounded in stock prices?

We explored this question at length in a 1984 article[31] because it seemed obvious to us that prices *couldn't* respond instantaneously to new public information except in unusual cases. In real markets, informational efficiency was necessarily a relative concept. Depending on the level of frictions, market prices would reflect different kinds of information with greater or less "relative efficiency."[32] Campbell, Lo, and MacKinlay echoed this conclusion twelve years later in a standard text on the econometrics of finance: "The notion of *relative* efficien-

[28] William F. Sharpe, Efficient Capital Markets: A Review of Theory and Empirical Work: Discussion, 25 J. Fin. 418, 418 (1970).

[29] William H. Beaver, Market Efficiency, 56 Acct. Rev. 23, 32 (1981).

[30] The extent to which CAPM, the Irrelevance Propositions, and the ECMH were originally proffered as perfect market theorems with the goal of framing a research agenda that would relax the perfect market assumptions to understand how real markets work and how real institutions respond to market imperfections is an interesting question. Those who proffered the theories later came to understand their work in that fashion. Assessing thirty years of efforts to show which market imperfections falsify the Irrelevance Propositions, Merton Miller acknowledged that "[l]ooking back now, perhaps we should have put more emphasis on the other, upbeat side of the 'nothing matters' coin: showing what *doesn't* matter can also show, by implication, what *does*." Merton H. Miller, The Modigliani-Miller Propositions After Thirty Years, 2 J. Econ. Persp. 99, 100 (1988). Sharpe himself acknowledged in his Nobel lecture that CAPM is compromised when there are institutional restrictions on short selling. William F. Sharpe, Capital Asset Prices With and Without Negative Holdings, 46 J. Fin. 489, 489, 500–08 (1991). And one of the authors roughly framed the role of business lawyers as that of transaction cost engineers, whose task was to craft a transaction structure that allowed the parties to act *as if* CAPM's perfect market assumptions were really true. Ronald J. Gilson, Value Creation by Business Lawyers: Legal Skills and Asset Pricing, 94 Yale L.J. 239, 253–55 (1984).

[31] Gilson & Kraakman, supra note 9, at 565–67.

[32] Id.

cy . . . may be a more useful concept than the all-or-nothing view taken by much of the traditional market-efficiency literature."[33]

Our argument proceeded by expanding Fama's three categories of information into four mechanisms by which prices could impound information and four categories of increasingly costly information.[34] By the early 1980s, a large body of empirical work demonstrated that stock prices responded extremely rapidly to most public—and even "semi-public"—information: In fact, they responded so rapidly that investors could not make arbitrage profits by trading on this information. We conjectured that two market mechanisms explain the rapid response of prices to such information: First, virtually all professional traders learn of certain information nearly simultaneously,[35] making a (nearly) instantaneous price response inevitable; or, second, a much smaller—but still sufficient—fraction of market professionals learn of new information within a short time frame—say, minutes or hours—and rush to trade on it before it is fully reflected in market prices. The second mechanism also causes market prices to reflect new information very rapidly, although not as rapidly as the first mechanism. Put differently, the second mechanism, which we termed "professionally informed trading," is relatively less efficient than the first. In highly liquid markets, such as those in exchange-traded stocks, some degree of inefficiency must always remain in order to permit savvy investors to earn at least normal market returns on average, and hence to incur the costs of analyzing and trading on new public information at all.[36] But if the second mechanism is rela-

[33] John Y. Campbell, Andrew W. Lo & A. Craig MacKinlay, The Econometrics of Financial Markets 24–25 (1997). The quotation continues:

> The advantages of relative efficiency over absolute efficiency are easy to see by way of an analogy. Physical systems are often given an efficiency rating based on the relative proportion of energy or fuel converted to useful work. Therefore, a piston engine may be rated at 60% efficiency, meaning that on average 60% of the energy contained in the engine's fuel is used to turn the crankshaft, with the remaining 40% lost to other forms of work such as heat, light, or noise.
>
> Few engineers would ever consider performing a statistical test to determine whether or not a given engine is perfectly efficient—such an engine exists only in the idealized frictionless world of the imagination. But measuring relative efficiency—relative to the frictionless ideal—is commonplace.

Id.

[34] Gilson & Kraakman, supra note 9, at 592–93.

[35] Consider, for example, an announcement by the Federal Reserve of a major change in its quantitative easing policy.

[36] As pointed out by Sanford Grossman and Joseph Stiglitz, professional traders must earn a normal return to incur the transaction costs of trading on new information. Sanford J.

tively less efficient than the first, it is still efficient enough to allow prices to reflect much information that is understood and acted on by relatively small numbers of traders almost as rapidly as information that the entire market learns at once.[37]

Other mechanisms for incorporating other kinds of information in price are much less efficient. For example, private information known only to insiders is likely to enter the market gradually, after insiders begin to trade on it and savvy outsiders subsequently deduce its content by observing insider trades or decoding unexpected movements in the market. In the public equity markets, the classic example is undisclosed corporate inside information that enters market prices only after managers trade on it or leak it to a handful of outsiders. Finally, a fourth remarkable, if relatively inefficient, market mechanism serves to channel noisy information into price even though no one knows this information for certain: This is the ability of market prices (in the right circumstances) to aggregate the independent forecasts of many traders with heterogeneous information, and thereby reflect in market price a collective forecast that is better informed than the forecast of any individual trader.[38] As a partial illustration, consider instances in which stock prices remain unaffected by the announcement of an economically significant change in the Federal Reserve's monetary policy because the change is said to have been correctly forecast by the market well before it was an-

Grossman & Joseph E. Stiglitz, On the Impossibility of Informationally Efficient Markets, 70 Am. Econ. Rev. 393, 404–05 (1980). It follows that prices can never be completely efficient vis-à-vis public information that is not universally known; there must always be some informational inefficiency to motivate arbitrage.

[37] Note that we did not—and do not—assume that these savvy traders know the precise weight that the market's implicit asset pricing model will assign information, whether it is semi-public, private, or unknown as of yet. In most circumstances, good traders will have a contextual understanding of the market's pricing model. For example, if newly released financial information leads expert analysts to question the "quality" of a firm's earnings (and therefore its future prospects), these analysts know that the firm's share price will fall relative to its price a moment before the information was released. They are also likely to have a rough idea of how far it will fall most of the time. In times of economic crisis, however, traders will have much less situational knowledge of the market's pricing model and so volatility—the number of pieces of new information with implications for the stock's price—will increase accordingly. See Fox, Fox & Gilson, supra note 1, at 23–25, 27–28.

[38] We term this last mechanism "uninformed trading." Gilson & Kraakman, supra note 9, at 579–80. It is the least efficient of the four market mechanisms, precisely because the true content of information is unknown and, as a result, price "averages" the partial information and opinion of all investors democratically. Id. We term the other three mechanisms, respectively, "universally informed trading," "professionally informed trading," and "derivatively informed trading." Id. at 566.

nounced; that is, it was "priced into" market prices prior to its announcement.

Note, however, that all of the preceding mechanisms for introducing information into price depend on the costs of information and the costs of arbitrage—that is, the costs of trading on information. Our previous articles have focused principally on determinants of these two categories of cost in the relatively well-functioning and continuous markets for public equities.[39] For example, in our 1984 article, we argued that information costs determine how widely particular information is distributed in a market, and therefore the relative efficiency of the market mechanism that incorporates it into price.[40] Much of our discussion there focused on the market frictions that contribute to information cost and the market institutions and regulatory interventions that have responded to these frictions. We continue to stress the costs of acquiring information in our reprise of the Subprime Crisis below; indeed, some information was not available at any feasible price. However, our account gives equal weight to the costs of trading on acquired information in order to introduce it into price. As we argue below, in the various markets associated with RMBSs, frictions introduced by the market structure itself often made the mechanism by which information comes to be incorporated into price much more salient than it is in the public equities markets. We now turn in Part III to an account of the determinants of informational efficiency of prices in the several Crisis-related securities markets.[41] As we will see, the magnitude of these costs figured centrally

[39] Gilson & Kraakman, supra note 9; Ronald J. Gilson & Reinier Kraakman, The Mechanisms of Market Efficiency Twenty Years Later: The Hindsight Bias, 28 J. Corp. L. 715 (2003) [hereinafter Gilson & Kraakman, Hindsight].

[40] Gilson & Kraakman, supra note 9, at 592.

[41] It is helpful to distinguish here between two common uses of the term "informational efficiency"—and among several meanings of "market"—that are sometimes conflated. As noted above, informational efficiency in the context of the ECMH refers to the speed with which particular information is fully reflected in the price of a given security. As we note in the text, however, the rapid reflection of information into price is a function of the trading market as well as the availability of the information. This implies that prices may be relatively very efficient with respect to available information, but also relatively "uninformed" in the sense that much value-relevant information about a security may not be available. Or, put differently, securities prices that are relatively very efficient in reflecting information are not necessarily deeply informed. The converse is not true, however. A thin trading market—say, an over-the-counter market in which a trade occurs once a week—may be very slow in reflecting even low-cost public information. The particular market mechanisms that reflect information in price in a securities market depend on the distribution—and hence the cost—of the information. See Gilson & Kraakman, supra note 9 and accompanying text; id. at 592–

in the Subprime Crisis. And as we will argue in Part IV, the ECMH, properly understood, focuses our attention on reducing these costs.

## III. THE SUBPRIME CRISIS AND INFORMATIONAL EFFICIENCY

Assessing the ECMH in light of the Subprime Crisis must begin by noting that at least three markets in securities and their associated derivatives are implicated in the Crisis: the markets in RMBSs, in CDOs (bonds tied largely to the returns on RMBSs), and in the stocks of financial institutions that were themselves active in the RMBS-CDO market as originators, securitizers, underwriters, insurers, or investors in the markets for mortgage-backed securities. Evaluating a modest ECMH, as we have defined it, requires some discussion of each of these. In each market the inquiry must be whether prices in one or more classes of securities responded rapidly (that is, with relative efficiency) to the public release of new, value-relevant information—at least when the ECMH would lead us to expect a relatively efficient price response to the new information. Conversely, do market frictions—high information costs and severe constraints on effective arbitrage—lead us to expect a high degree of market inefficiency, implying that the ECMH is a useful tool for understanding and possibly improving the informational quality of market prices?

ECMH critics might argue that market prices failed to reflect various kinds of information efficiently (or at all) prior to the Crisis, some of

93. But in the absence of active trading and visible prices, even the cheapest information may fail to be fully reflected in price.

The second point concerning the use of the term "market" also requires clarification. There is, on one level, a single secondary market in public equities in America ("The Market"), insofar as a relatively well-defined list of stocks is subject to the same disclosure requirements, the same regulator, the same liability rules, etc. On another institutional level, there are multiple markets with different institutional underpinnings; for example, issuers whose shares trade on the NYSE, NASDAQ, in "blind pools," over-the-counter, etc.—and are subject to commensurately more or less exacting scrutiny by auditors, investors, regulators, analysts, and the press according to their market capitalization and other factors. For purposes of addressing relative market efficiency, however, the relevant market is still more specific: It is the market in the particular security under consideration, a market that is nested in the broader institutional context of The Market (that is, the institutional and legal structures that govern trading in all public equities). Thus, to ask whether the American market in publicly traded equities is relatively efficient is ambiguous. A much more meaningful question is whether market prices for specific equities subject to a threshold level of trading volume and a certain level of scrutiny by auditors, analysts, regulators, and the investing public are likely to be semi-strong form efficient. The federal courts must ask just this question in assessing the merits of fraud-on-the-market litigation. See supra note 5.

which were specific to the markets in particular securities. Yet information about the likely future behavior of the housing market and the default risks associated with subprime and alt-prime mortgages was clearly relevant in all of the securities markets associated with the Crisis. To reprise the familiar, the residential housing market—not a securities market—was the foundation on which prices in all of the Crisis-related securities markets depended. We concur with the now widely accepted view that the housing market experienced an enormous bubble beginning in 2001, if not earlier, and ending in the fourth quarter of 2007, when housing generally collapsed.[42] The source of this bubble was macroeconomic but it was exacerbated by the markets in mortgage-backed securities. A substantial increase in global liquidity reduced the price of credit, which in turn increased the demand—and hence the price—of homes. In addition, new mortgage products that required little or no down payment further expanded the availability of credit, and thus also increased demand for housing with a similar effect on housing prices. In particular, mortgage products with low introductory interest rates encouraged home sales even when buyers might have been unable to service their mortgages after their initially low "teaser" interest rates ended two or three years out. This increased the number of potential homebuyers relative to the much lower rate of growth in housing stock, and thus also increased housing prices, at least for the short run.[43]

Thus one critical "bit" of information may be "public" in the sense of being cheap to acquire: namely, knowledge of the existence of a housing bubble and its corollary, the knowledge that sooner or later residential

[42] On this point we differ from Eugene Fama, the most prominent advocate of ECMH. See John Cassidy, Interview with Eugene Fama, New Yorker (Jan. 13, 2010), www.newyorker.com/online/blogs/johncassidy/2010/01/interview-with-eugene-fama.html. Fama conjectures that housing prices fell victim to an incipient worldwide recession that was unforeseen by almost all sophisticated financial actors. Id. In our view, however, whether one believes that a bubble in the housing market and its associated financial assets triggered the crisis, or, as Fama believes, that developments in the real economy triggered a fall in real estate prices and the Subprime Crisis, does not bear importantly on the modest conception of the ECMH that we discuss in this Article or the policy implications that follow from it.

[43] By housing bubble we only mean that housing was costly relative to historical prices. Was housing also costly relative to its "fundamental value"? In light of what level of liquidity and over what range of mortgage products should fundamental value be measured? The condition of the housing market and the mortgage financing that fueled it are critical to assessing the implications of the Subprime Crisis for the ECMH, but the housing market itself is not a trading market in which the informational efficiency of prices can be easily evaluated.

real estate prices were likely to fall—and perhaps even fall dramatically. It seems plausible that many savvy investors in the mortgage-backed securities had this knowledge. As early as 2003, Robert Shiller provided strong evidence of a housing market bubble. Moreover, a close student of the Crisis, the economist Gary Gorton, has asserted that, contrary to the popular accounts, investors generally believed that real estate prices had entered a bubble phase at least two years before the crash occurred. Nevertheless, this knowledge alone was not enough to induce them to take the risky step of shorting mortgage-backed securities markets (to the extent that this was possible). The investors who did take this step and profited as a result were not visionaries; rather, they were lucky in their timing, since "[m]any saw the coming crisis. This was the subject of intense debate starting in 2005."[44]

Assume, then, that many professional investors recognized a bubble in housing prices and forecast a sharp decline or even a crisis in the housing market by the start of 2005. There were still two other critical bits of information missing: a useful forecast of when the bubble was likely to burst and knowledge of the consequence of a sharp drop in housing prices for each of the relevant securities. We argue below that this information was likely to have been much more difficult—that is, costly—for investors to obtain than a general sense that the housing market was overpriced. Additionally, we argue that insight into the timing of the crash and its likely consequences might not have reached prices in the mortgage-backed securities markets even if it were "known" to a minority of traders. We proceed below to examine each of the relevant securities markets.

### *A. The RMBS Market*

Most residential mortgages (aside from non-conforming jumbo mortgages) were bundled into pools and sold to passive "special purpose vehicles" for purposes of securitization. These entities purchased mortgages with funds raised by selling fixed-income securities to investors—tranched bonds backed by the cash flows of the mortgage pools. Bonds backed by the most senior tranche of RMBSs generally received an

[44] Gary Gorton, Book Review, 49 J. Econ. Literature 450, 451 (2011).

AAA rating by at least two of the three major rating agencies.[45] Subordinated bonds were rated AA, A, and so forth down to BBB-, the lowest investment-grade rating below which there was only a thin level of unrated "equity." Senior RMBS bonds were liquid and traded frequently until the Crisis was in full bloom during the last months of 2007, even when they were issued by exclusively subprime mortgage pools. Bonds backed by lower tranches of a mortgage pool—for example, the BBB or BBB- bonds—were less liquid.

The RMBSs, in turn, spawned two derivative markets. The first was the over-the-counter ("OTC") market in credit default swaps ("CDSs") written on RMBS bonds, which were initially introduced to large investors in January 2005.[46] CDS contracts on bonds are a form of default insurance that requires the buyer to pay a percentage of the face value of a bond or other credit obligation in exchange for the seller's promise to reimburse the face value of the debt (minus its residual market value) should the debt default. Over-the-counter CDS contracts became the first cost-efficient way to short RMBS-backed bonds.[47]

The second derivative to emerge from the RMBS market extended only to bonds backed by subprime mortgage pools.[48] This was the trading platform in so-called "ABX" indices that were introduced by Markit, a UK corporation, in January 2006. Markit referenced its subprime indices to the market prices of bonds issued by the twenty largest RMBS offerings within a discrete six-month period, beginning with subprime RMBS bonds issued during the second half of 2005. These ABX indices reflected an unweighted average of the prices of the rated bonds issued against each tranche of RMBS mortgage pools. In effect, the ABX market offered a vehicle for investors to go long or short in any rated

[45] The three major rating agencies are Standard & Poor's, Moody's Investors Services, and Fitch. See generally John C. Coffee, Jr., Ratings Reform: The Good, The Bad, and The Ugly, 1 Harv. Bus. L. Rev. 231, 248 (2011) (discussing rating agencies and the Subprime Crisis).

[46] John Geanakoplos, Solving the Present Crisis and Managing the Leverage Cycle 111 (Yale Univ. Cowles Found. for Research in Econ., Paper No. 1305, 2010), available at http://dido.wss.yale.edu/P/cp/p13a/p1305.pdf; accord Luigi Zingales, Credit Default Swaps on Trial, Project Syndicate (Apr. 19, 2010), http://www.project-syndicate.org/commentary/credit-default-swaps-on-trial. A standardized CDS contract for RMBS bonds was later introduced by the International Swaps and Derivatives Association in June 2005. See Michael Lewis, The Big Short: Inside the Doomsday Machine 49 (2010).

[47] See Lewis, supra note 46, at 11.

[48] Subprime mortgages are those mortgages offered to borrowers with poor credit histories and they are characterized by their high interest rates, relatively unfavorable terms, and low-quality collateral.

tranche of the subprime RMBS market. Soon after the ABX market opened, volume ballooned—much of it initiated by investors shorting subprime bonds. Much of this shorting may have been by large banks and other institutions seeking to set off the risk they bore on large stocks of subprime RMBSs, which they held either on their own accounts or as "warehoused" bonds for later use in the construction of third-level mortgage-backed securities discussed below.[49] Doubtless, investors seeking naked bets against subprime mortgage markets accounted for additional shorting activity. At the outset of trading on ABX indices in January 2006, subprime mortgages comprised roughly a quarter of the entire mortgage-backed securities market.[50]

Prices in the ABX market provided low-cost information on how investors as a whole evaluated the quality of these securities—information that had hitherto been unavailable. The effect was transformational. In the words of Gary Gorton: "With the advent of the ABX indices, market participants could, for the first time, express views about the value of subprime bonds, by buying or selling protection. For the first time information about subprime values and risks was aggregated and revealed."[51]

Since highly rated RMBSs were relatively liquid in the OTC market and subprime indices were actively traded on an exchange, pricing in both markets clearly responded to new information. Indeed, price movements in ABX indices during the Crisis predicted price movements in broader markets by as much as three weeks—either by informing these large markets or by causing them to react.[52] To be sure, heavy

[49] The history and structure of the ABX securities indices are canvassed in Nancy Wallace, The Bear's Lair: Index Credit Default Swaps and the Subprime Mortgage Crisis (Feb. 2, 2011) (unpublished manuscript), available at http://ssrn.com/abstract=1787848.

[50] See Lewis, supra note 46, at 27.

[51] Gary Gorton, Information, Liquidity, and the (Ongoing) Panic of 2007, at 4 (Nat'l Bureau of Econ. Research, Working Paper No. 14649, 2009) [hereinafter Gorton, Information], available at http://www.nber.org/papers/w14649; see Gary Gorton, The Subprime Panic 23 (Nat'l Bureau of Econ. Research, Working Paper No. 14398, 2008), available at http://www.nber.org/papers/w14398 (arguing that ABX indices solved the RMBS market's common knowledge problem). Contemporaneous market professionals made the same point well before Gordon did. See, e.g., Kevin Kendra, Tranche ABX and Basis Risk in Subprime RMBS Structured Portfolios, Derivative Fitch 47 (Feb. 20, 2007), http://www.fitchratings.com/web_content/sectors/subprime/Basis_in_ABX_TABX_Bespoke_SF_CDOs.ppt ("The ABX.HE has proven to be effective in providing market transparency in an otherwise opaque market.").

[52] See Francis A. Longstaff, The Subprime Credit Crisis and Contagion in Financial Markets, 97 J. Fin. Econ. 436, 437 (2010); James R. Hagerty & Serena Ng, Does Subprime In-

shorting of the ABX indices lowered their implicit returns below those of the cash securities underlying the indices in late 2006. For example, for months the market priced the ABX BBB index at thirty basis points below the return on the cash subprime BBB bonds that the ABX BBB tranche indexed. This may have been an instance of inefficiency in these markets; the returns on the BBB index and the referenced BBB cash assets should have been identical or nearly so.[53] If so, however, it was an inefficiency that was heavily arbitraged. Equally important, the extent to which enormous demand for protection against a decline in the housing market pushed down the prices of the ABX seems in retrospect to be a hint of the Crisis yet to come in late 2007.[54]

Given that the secondary markets in RMBS subprime ABX indices were reasonable candidates for reflecting public or semi-public information in prices, the issue is whether they did so. What information—assuming it was widely known—failed to enter prices at this intermediate level?

Consider first the declining quality of the mortgages that flowed into subprime mortgage pools. At least prior to 2006, it seems that prices of bonds issued against subprime mortgage pools failed to reflect the progressive deterioration of the quality of subprime mortgages. Some commentators assert that this decline in mortgage quality was clearly evident as early as late 2005.[55] Would the failure of prices to reflect this information imply price inefficiency? Recall that the market in ABX indices was introduced in January 2006. Before this, RMBS price information in the OTC market was qualified and incomplete. Perhaps the timing of the introduction of the ABX indices was not accidental. In any event, the new ABX market faced strong and immediate shorting of subprime bonds, driven in no small part by the demand for insurance by those holding the securities. In addition, increasing housing prices would have

dex Amplify Risk?, Wall St. J., Feb. 27, 2007, http://online.wsj.com/news/articles/SB117253842321420060 (quoting a CreditSight analyst commenting that "the ABX is accurately reflecting the panic being felt by some of the big mortgage players").

[53] See Gorton, Information, supra note 51, at 7 fig.2.

[54] For further evidence that the demand for these securities as insurance drove down the price of the index such that it no longer served as an accurate measure of the default risk associated with the securities, see Wallace, supra note 49, at 44. In effect, the price overstated the likelihood of default because the security price was driven by demand for the insurance function rather than expected future defaults.

[55] Yuliya Demyanyk & Otto Van Hemert, Understanding the Subprime Mortgage Crisis, 24 Rev. Fin. Stud. 1848, 1866 (2012).

disguised the declining quality of subprime mortgages as long as increases in home prices continued. Even the worst "liar loan" retained its value if it paid interest and was easily refinanced. Thus, information about the deteriorating quality of subprime mortgages may have been a secondary consideration to market traders.

And what of the alleged failure of the broader RMBS market to anticipate the decline in home prices? Here we plead no contest. As indicated above, many investors suspected a housing bubble and yet remained deeply uncertain about the timing and extent of its correction. Housing prices had risen almost continuously for three decades prior to the Subprime Crisis.[56] Moreover, there was a twist in the mortgage-backed securities markets. The consequences of increasing default rates differed significantly by rating in the RMBS market—most AAA RMBS bonds retained their value throughout the Subprime Crisis. By contrast, the positions of holders of AAA bonds in mezzanine CDO bonds—considered

[56] See, e.g., Gary Gorton, Misunderstanding Financial Crises: Why We Don't See Them Coming 221 (2012); Wallace, supra note 49, at 29–30. Among other evidence indicating that market professionals did *not* anticipate a break in housing prices during the 2004–2006 period are data indicating that a large sample of mid-level executives in securitized financing personally invested in real estate as aggressively—if not more aggressively—than comparably situated control groups. Ing-Haw Cheng et al., Wall Street and the Housing Bubble 3–4 (Nat'l Bureau of Econ. Research, Working Paper No. 18904, 2014), available at http://ssrn.com/abstract=2232233. There is, of course, apparently contradictory evidence that some investment bankers underwriting CDOs knew perfectly well that the subprime RMBSs they placed in their CDO asset portfolios were of particularly low quality and likely to default within a timespan brief enough to profit from shorting their own CDOs. See, e.g., Jesse Eisinger, Financial Crisis Suit Suggests Bad Behavior at Morgan Stanley, N.Y. Times DealBook (Jan. 23, 2013, 12:00 PM), http://dealbook.nytimes.com/2013/01/23/financial-crisis-lawsuit-suggests-bad-behavior-at-morgan-stanley/?_php=true&_type=blogs&_r=0 (reporting that bankers jokingly named the CDOs created and sold to Chinese and Taiwanese banks in the first half of 2006 "Subprime Meltdown," "Hitman," and "Nuclear Holocaust" before shorting their own creation). Assuming the worst, however, this evidence does not necessarily bear on what these banks assumed to be the case about the RMBS market in general since it appears that they cherry-picked the market for especially default-prone RMBS mortgage pools. Similarly, there is evidence that investors who invested heavily in private information were able to profit handsomely from long positions in RMBSs through the Crisis and afterwards. See BlackRock Solutions Fin. Mkts. Advisory Grp., Financial Markets Advisory: Residential Mortgages (2010), available at https://www.blackrock.com/institutions/en-us/literature/investor-education/blk-insti-fma-residential-mortgages.pdf (touting the performance of RMBS investments informed by proprietary zip code-level, continuously-updated mortgage data, and proprietary valuation models). Again, however, earning strong positive returns on long positions in RMBSs—including RMBSs backed by subprime mortgages—required costly information and cherry-picking for particularly low-risk mortgage pools that were mispriced by a less well-informed market.

below—were initially more opaque and ultimately far less favorable than those of the holders of AAA RMBS bonds.

In addition, a third sort of relevant pricing information is endogenous to hierarchically layered markets. Continued institutional demand for AAA bonds in the top-tier CDO market had raised the value of the assets in the markets below. Securitizers of mortgage pools depended on CDOs to place their riskier securities, and the demand for mezzanine CDO AAA securities in turn stimulated originators to generate more mortgages, which, as noted before, further inflated housing prices. Nevertheless, housing purchases were the prime movers in the cycle. Changes in home prices registered virtually instantaneously in the movement of ABX indices, while institutional purchasers of AAA CDO bonds were much slower to react to declining housing prices.

### *B. The Market for CDOs and Associated Derivatives*

The second mortgage-backed bond market central to the Subprime Crisis was the market for CDO bonds. This market was at the top of the market hierarchy in mortgage-backed securities in much the same sense that the housing market was at the bottom. Like RMBS entities, CDOs were special purpose vehicles that issued bonds backed by the returns on variously rated tranches of their underlying asset pools. Most mortgage-linked CDO assets were mid- and lower-tranche RMBS holdings, although higher-tranche RMBS bonds, and even securitized credit card and corporate debt, also might have been included in the mix. Unlike the pools of securitized mortgages, however, CDO asset portfolios were actively managed; that is, as bonds in these portfolios matured, CDO "managers" selected new assets as replacements—again, usually the BBB or "mezzanine" tranches of RMBS bonds. CDO managers also conventionally selected the inventory in a CDO's initial portfolio and earned embedded fees that were senior to any distributions to CDO bondholders. For example, a CDO—call it "IBEX"—might purchase all of one subprime RMBS BBB bonds, half of RMBS A- bonds, and so on, until IBEX had an asset pool that included various tranche-backed bonds of 100 RMBS. IBEX would then divide its cash flows into as many as thirteen rated tranches, each of which would then collateralize classes of bonds for purchase by institutional investors.

The value of a typical CDO's asset portfolio was enormous in comparison to the value of the individual securitized mortgage pools: One or two billion-dollar CDO entities were the norm. CDOs that relied primar-

ily on RMBS assets emerged on a large scale in 2005, peaked in 2006, and dwindled to almost nothing by the first quarter of 2008.[57] Some commentators generally agree that a principal reason for the rise in CDOs during 2005 and 2006 was an effort by underwriters to create buyers for otherwise illiquid mezzanine RMBS tranches.[58] Adam Levitin and Susan Wachter argue that the 2005–2006 explosion in CDO issues extended the Subprime Crisis by creating demand for mezzanine RMBS securities (for example, BBB- bonds) that would otherwise have choked the securitization "pipeline,"[59] that is, the originators, securitization specialists, CDO sponsors, and CDO underwriters that created and distributed products to meet strong investor demand for AAA and AAA+ bonds. By 2005, fifty percent of higher quality senior CDO bonds and seventy-seven percent of senior mezzanine CDO bonds were collateralized by subprime mortgages assets.[60]

The rating agencies routinely awarded the coveted AAA rating to bonds backed by the top tranches of CDOs even though the cash flows of these CDOs derived largely from riskier BBB tranches of RMBS mortgage pools—and often from those of subprime BBB tranches at that. Whether this was—or was not—paradoxical was a matter of perspective at the time. If, after all, ten percent of all RMBS mortgage pools were to default on *all* of their bonds (from equity to AAA)—a worst case scenario in 2005—the remaining ninety percent of the BBB cash flows would suffice to cover a CDO's line of AAA-rated bonds. The risk profile of the typical mezzanine CDO allocated sixty-two percent of its net cash flows to senior AAA bonds, fourteen percent to junior AAA bonds, and eight percent to AA bonds. A ten percent default rate in the underlying subprime collateral would still permit these three (senior AAA to AA) bonds to be paid in full while the remaining A through BBB- bonds and a thin layer of unrated "equity" took the hit.[61] In addition, CDO issuers typically fortified their senior (or "super safe") AAA bonds with risk-limiting devices, such as placing some conspicuously low-risk assets in their asset portfolios or over-collateralizing top-tranche bonds by shifting risk to lower tranches.

[57] See Gary Gorton, The Subprime Panic, 15 Eur. Fin. Mgmt. 10, 26 tbl.5 (2009).
[58] See id. at 18.
[59] See Adam J. Levitin & Susan M. Wachter, Explaining the Housing Bubble, 100 Geo. L.J. 1177, 1237–42 (2012).
[60] Gorton, supra note 57, at 27 tbl.5.
[61] See id. at 24 fig.3.

Alas, however, a different outcome would follow if no RMBS entity defaulted on all of its bonds but numerous entities defaulted on bonds of BBB seniority and below. As proved to be the case, this would happen if cash flows across RMBSs were highly correlated. And its consequence would be that mezzanine CDOs that issued bonds against asset pools that included many BBB RMBS bonds might be forced to default on even their most senior AAA bonds.

By and large, the underwriters of CDOs were the large investment and commercial banks. CDOs were usually issued directly to their ultimate purchasers who, in the case of AAA-rated bonds, were generally institutional investors such as insurance companies, pension funds, hedge funds, or German *Landesbanken*. These CDOs were bespoke and illiquid. For the most part, they were acquired as long-term portfolio assets.[62] Indeed, most institutional investors would *only* purchase CDO bonds at an initial distribution—that is, in the "primary market"—thereby eliminating the possibility of a secondary market. The literature speculates that institutional investors avoided purchasing on a secondary market for fear that they would become victims of adverse selection, since the only sellers would be more knowledgeable owners who believed the securities were overpriced.[63] It seemed safer to purchase on the primary market when many other institutions were purchasing simultaneously and where the seller was a repeat player.[64] There is little evidence to suggest that the lower-rated tranches of bespoke CDOs were more liquid than the senior tranches, and the analogy of low-rated RMBS bonds suggests that they were most likely even less liquid, were it not for the fact that AAA CDOs were themselves illiquid.

Why did institutional investors of all sorts purchase AAA-rated bonds backed by mezzanine CDO entities? Perhaps the best answer is that the institutional buyers understood these bonds to be safe—to have the same risk characteristics as AAA corporate bonds, for example. Andrew Lo quotes a 2006 story in the *Financial Times* in which the European head of structured products at Fortis Investments was asked to explain the

[62] See Martin Scheicher, How Has CDO Market Pricing Changed During the Turmoil? Evidence From CDS Index Tranches 5 (Eur. Cent. Bank, Working Paper No. 910, 2008), available at http://ssrn.com/abstract_id=1147094.

[63] See Guillaume Plantin, Learning by Holding and Liquidity, 76 Rev. Econ. Stud. 395, 395 (2009).

[64] Id.

enormous growth in CDO bond issues during 2005.[65] The explanation he offered was simple: "You buy a AA-rated corporate bond you get paid Libor plus 20 basis points; you buy a AA-rated CDO and you get Libor plus 110 basis points."[66] As Lo notes with some irony, no hidebound believer in the ECMH would have made such an assumption.[67] The takeaway is that the majority of the managers of the institutional buyers of CDOs either believed rating-agency evaluations of risk and trusted the storied reputations of underwriters such as Goldman Sachs or, alternatively, they knew that they would not be penalized for acting as if they believed this to be so. Thus, purchasing a super-safe tranche of an asset-back security ("ABS") CDO was a no-brainer—more yield, lower risk, and no blame. Institutional buyers did not attempt to independently value the securities they purchased. Doing so would have required capabilities that few of them possessed. Like a handful of other asset classes such as federal reserve notes, AAA CDO bonds were considered to be extraordinarily safe, safer even than similarly rated corporate bonds. In the post-Crisis vocabulary, these bonds were considered so safe that they were "information-insensitive"—meaning that they were near substitutes for treasury bills and cash, (almost) without risk, and therefore acceptable as efficient collateral in financial transactions.[68] They were routinely used as such in the short-term money market and were treated favorably as bank capital by the Basel II Accord.[69] In fact, demand for super safe AAA CDO bonds seems to have exceeded supply, a market condition that Gary Gorton conjectures led to a parallel explosion of "synthetic" CDOs in 2005 and 2006.[70]

[65] Andrew W. Lo, Reading About the Financial Crisis: A Twenty-One-Book Review, 50 J. Econ. Literature 151, 152 n.4 (2012).

[66] Id.

[67] See id. at 152.

[68] See Gary Gorton, Stefan Lewellen & Andrew Metrick, The Safe-Asset Share 1 (Nat'l Bureau of Econ. Research, Working Paper No. 17777, 2012), available at http://www.nber.org/papers/w17777.

[69] See Basel Comm. on Banking Supervision, International Convergence of Capital Measurement and Capital Standards: A Revised Framework 104, 107 (2006), available at http://www.bis.org/publ/bcbs128.pdf.

[70] Gorton, supra note 57, at 28–29. Exposure to BBB-rated subprime RMBSs was 160% of issues comprised of cash securities in 2005, and 193% in 2006. Id. This is roughly equivalent to saying that, by dollar value, 37.5% of mezzanine CDOs issued in 2005 and 48.2% of those issued in 2006 were synthetic CDOs. Overall, about 25% of all CDOs issued between 2004 and 2007 were synthetic. Id.

Inevitably, the introduction of CDOs into the mortgage-backed securities market led to the introduction of CDS protection of CDOs—and in the case of synthetic CDOs, CDSs and CDOs were born simultaneously. Both derivative securities referenced the same large set of underlying mortgage pools and shifted cash flows to one another *as if* CDOs had actually purchased the referenced cash assets. But standard CDS contracts and indices, while they existed,[71] played a much smaller role in the CDO market than they did in the RMBS market. Apart from the fact that the Crisis left the CDO market little time to evolve, the likely reasons were that CDOs were enormously more complex, difficult to value, and illiquid than were pools of RMBS bonds.[72] Bespoke CDS protection on individual CDO tranches of bonds was written either by the CDO managers themselves or by a few large institutions, such as AIG, Lehman Brothers, and monoline insurers. And it was famously purchased by a small number of investors who wished to short the market, as well as by larger numbers of banks that retained AAA CDO bonds and wished to limit their exposure to asset-backed security risk.[73]

The widespread perception prior to mid-2007 that AAA CDOs were "super safe" was of course incorrect, at least for mezzanine CDOs. Should we have expected the CDO market to have discovered this fact on its own before the Crisis? The short answer is no. As a primary market with very little active trading, the CDO market was simply not structured in a way that facilitated arbitrage before the Crisis struck.

Did institutional purchasers evidence naiveté or cognitive bias by accepting the prices that underwriters offered without seeking independent valuations? Ex post one can see warning signs that might have led to greater caution. By mid-2005, the Bank for International Settlements had already warned of potential problems in underwriter valuation models—especially of the danger of high correlations among portfolio as-

[71] See, e.g., Lewis, supra note 46, at 130. Note that the standardized CDS contract on CDOs entered the market almost exactly one year after the standard CDS contract on RMBSs. See Gorton, supra note 57 and accompanying text.

[72] For an excellent account of the complexity of structured instruments in the mortgage-backed securities market, see Kathryn Judge, Fragmentation Nodes: A Study in Financial Innovation, Complexity, and Systemic Risk, 64 Stan. L. Rev. 657 (2012). For an argument based on experimental evidence that complexity increases price volatility, lowers liquidity, and reduces trading efficiency, see Bruce Ian Carlin et al., Trading Complex Assets, 68 J. Fin. 1937, 1937–38 (2013). The authors observe that complexity reduces the asset prices, not merely by increasing information costs to traders, but also by altering bidding strategies and making investors less likely to trade. Id. at 1938–39.

[73] See Lewis, supra note 46, at 77; Wallace, supra note 49, at 2–3.

sets—and against putting too much faith in the rating agencies.[74] It seems more plausible, however, that institutional investors rationally relied on the reputations and models of the rating agencies and the major banks that served as underwriters. Asset-backed CDOs had performed well in years immediately preceding the Crisis, and AAA-rated bonds, even from mezzanine subprime CDOs, were widely accepted in the market as virtually riskless securities. Indeed, they were better than that—these were AAA-rated bonds that paid a premium return relative to other securities thought to be super safe.[75]

Did the underwriters of subprime AAA CDOs—and the agencies that rated these bonds—deliberately mislead their institutional buyers about the risk involved? Certainly there is evidence that rating agencies gradually relaxed their standards for rating these securities from 2004 to 2006. And there is evidence that the quality of subprime CDOs declined as well, both in the quality of individual subprime mortgages and in the percentages of subprime mortgages in CDO portfolios. Moreover, underwriters often withheld information from the purchasers of CDO-backed bonds that might have been considered material—the most infamous example being the case of the ABACUS CDO, in which a hedge fund helped to select the reference RMBSs for a synthetic CDO that Goldman Sachs underwrote, and then promptly shorted the CDO once its bonds had been placed.[76] On the other hand, there is also evidence of rating agencies and CDO underwriters acting in good faith. Many large banks added a portion of the super-safe tier of the CDO bonds that they underwrote to their core capital, a decision that cost them dearly during the Subprime Crisis. The valuation models employed by the banks and the rating agencies failed for reasons that are obvious in retrospect but

[74] See, e.g., Bank for Int'l Settlements, The Joint Forum: Credit Risk Transfer 24–29 (2005), available at http://www.bis.org/publ/joint13.htm. A subsequent revision of this report, published in 2008, demonstrates the validity of the concerns raised in 2005. See Bank for Int'l Settlements, The Joint Forum: Credit Risk Transfer 1–2 (2008), available at http://www.bis.org/publ/joint21.htm.

[75] In addition, of course, the managers of institutional buyers enjoyed the benefits of rational herding. But this is rational behavior as well, at least from the standpoint of the individual manager-agent. See Claire A. Hill, Why Didn't Subprime Investors Demand a (Much Larger) Lemons Premium?, 74 Law & Contemp. Probs. 47, 49–50, 59 (2011).

[76] Press Release, U.S. Sec. and Exch. Comm'n, SEC Charges Goldman Sachs with Fraud in Structuring and Marketing of CDO Tied to Subprime Mortgages (Apr. 16, 2010), available at http://www.sec.gov/news/press/2010/2010-59.htm; see also Jesse Eisinger, supra note 56, at 3–6 (describing evidence that Morgan Stanley, among other banks, also shorts its own CDOs).

were not obvious at the time, such as the use of historical housing price data to estimate the future performance of CDO portfolios. But whatever their intentions, there is no question that banks and rating agencies performed poorly as informational intermediaries, with the effect of juicing the institutional investor market for senior subprime CDO securities. There were massive frictions and informational asymmetries in the market for these securities. The question is: What do these imperfections imply for the ECMH?

The answer is "not much" for a modestly sized ECMH. Again, senior subprime-backed CDO bonds were issued in a primary market and were not traded in a secondary market. As Gorton stresses, "over-the-counter markets seem to aggregate information very differently than . . . stock markets."[77] The claim that market prices are informationally efficient requires astute traders to seek profit by trading on new information. The assumption of active trading underlies all of the efficiency mechanisms that aggregate information into price. A primary market without an aftermarket simply lacks the structure to converge on efficient prices.

### *C. The Stock Market and Publicly Traded Financial Institutions*

The last market one might have expected to play an important role in the Subprime Crisis was the stock market. After all, most underwriters of CDOs were publicly traded banks, the largest independent originators and securitizers of mortgages—such as Countrywide Financial Corporation—were publicly traded, and the few large financial institutions that sold CDS insurance on CDO bonds—such as AIG, Lehman Brothers and the monoline insurer Ambac Financial Group—were also publicly traded. In general, however, the stock market appears to have been a latecomer rather than a leader in recognizing signs of the onset of the Subprime Crisis. Why did share prices not reflect deterioration in the quality of CDO securities, agency ratings, and quality of mortgages well before the Subprime Crisis was in full throat?

Once again, the most plausible answer is that obtaining and interpreting information about prices was not easy for traders in the equities markets.[78] To begin, the senior tranches of bespoke CDOs—together

[77] Gorton, supra note 56, at 207.

[78] See generally Robert P. Bartlett, III, Inefficiencies in the Information Thicket: A Case Study of Derivative Disclosures During the Financial Crisis, 36 J. Corp. L. 1 (2010) (examining the effects of enhanced derivative disclosures); Hill, supra note 75. Bartlett finds evi-

with CDS protection on the other side of the bet—were extremely difficult to value. In addition, the business activities of giant banks and financial institutions such as AIG are diverse, and financial statements do not necessarily segregate their activities. Further, CDO bonds were unlikely to be "marked to market" given their lack of liquidity and were sometimes carried off the books entirely.[79] To be sure, some evidence of uneasiness was reflected in the behavior of some big banks. Morgan Stanley, Credit Suisse, Deutsche Bank, and eventually Goldman Sachs were worried enough to wind down their CDO operations and short or hedge the CDOs that remained in their warehouses in 2005 and in the

dence inconsistent with the ECMH in a case study of the share price movements of the Ambac Financial Group (Ambac), a widely held monoline insurance company with heavy exposure to twenty-eight CDOs. While Bartlett's study is not easily summarized, its principal findings include the observations that Ambac share prices exhibited proportionately negative abnormal returns when the credit rating agencies downgraded the bonds of a company it had insured by several steps prior to the Subprime Crisis. In contrast, however, Ambac's share prices failed to respond significantly to even larger multistep downgrades of six of its twenty-eight CDOs, even though Ambac's aggregate exposure on its CDSs far exceeded its financial exposure on the downgraded corporate bonds that it had previously insured. In addition, Ambac's share prices fell significantly when Ambac itself announced, inter alia, sharp reductions in book value due to growing liability from its CDSs, or sharp decreases in its quarterly income—both pieces of bad news that predictably paralleled the earlier rating downgrades of the CDOs "insured" by Ambac's CDSs. Bartlett acknowledges that share prices might already discount for the bad news reflected by rating downgrades—the explanation that we would find more intuitive. Bartlett, supra, at 31. Nevertheless, he rejects this explanation, in part because of the market's seeming failure to respond to the bad news already implicit in rating downgrades until poor earnings or asset write-downs make it too obvious to overlook. Bartlett expresses his point in terms of "salience," that is, the hypothesis that even savvy investors may overlook new information with large valuation consequences if it does not appear salient at first glance. Id. at 54. Newspaper coverage or issuer disclosure may make information salient, and therefore worthy of additional analysis, when arbitrageurs might otherwise ignore it, simply because their time and attention are limited resources. Putting aside event studies, we agree that the salience hypothesis is plausible. We would reframe it, however, not as cognitive bias but as a matter of information costs. Thus the cost of learning bad news quickly enough to act on it may be high, but it becomes slightly lower on an ex ante basis if newspaper coverage or issuer disclosure makes arbitrageurs more likely to notice it. Regarded this way, salience is a matter of probability-discounted cost rather than of cognitive bias. In this sense, the distinction is similar to that between behavioral and rational accounts of herding. See supra note 74 and accompanying text.

[79] See infra note 141 and accompanying text (discussing accounting valuation of mortgage-backed securities); see also Bartlett, supra note 78, at 6–7 (identifying two circumstances when, because of particular regulators' requirements covering monoline insurers, an insurer's exposure to CDOs and CDSs could, with difficulty, be roughly observed). Bartlett also recounts the very large costs associated with the effort.

first half of 2006.[80] However, such strategic maneuvering was unlikely to be visible to shareholders, and many other institutions of similar size and reputation seemed unconcerned during this period. Again, the only markets in which prices may have anticipated the coming Subprime Crisis were the ABX BBB and BBB- subprime indices, as we discuss briefly below. Even the Chicago Mercantile Exchange in three-month housing futures exhibited "relative stability in market expectations until a decline in the fourth quarter of 2007 and then a precipitous drop at the very end of 2007 and beginning of 2008."[81]

Thus, the evidence is that most astute investors did not anticipate a steep drop in housing prices immediately prior to its occurrence, whether or not they believed in an enormous bubble in housing prices. This outcome is entirely consistent with the ECMH, which maintains that prices in a relatively efficient market will respond rapidly to new public information, but does not maintain the converse proposition—namely, that every sharp turn in market prices can be traced to identifiable fresh public information. Nor, of course, does the ECMH permit information to enter the market that fixes the time of future collapse in prices, since such information cannot exist without immediately causing the collapse it predicts.

### *D. A Note on Behavioral Finance*

If the market behavior accompanying the Subprime Crisis is consistent with the ECMH, can the same be said about its compatibility with hypotheses rooted in behavioral finance? In an earlier article, we discussed the variety of behavioral hypothesis biases that might plausibly interfere with rational pricing based on public information.[82] Much of

[80] See Tristana Moore, Deutsche Bank Boss Dodges Crisis, BBC News, (Feb. 8, 2008, 9:34 AM), http://news.bbc.co.uk/2/hi/business/7234292.stm; Neil Unmack & Sebastian Boyd, CDO Losses May Be $52 Billion, Credit Suisse Says, Bloomberg, (July 9, 2007), http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aPKIHSk5cS50&refer=home.

[81] Allen Ferrell & Atanu Saha, Securities Litigation and the Housing Market Downturn, 35 J. Corp. L. 97, 115 (2009).

[82] See Gilson & Kraakman, Hindsight, supra note 39, at 736–41. In that article we acknowledged that an analysis based in part on the cognitive biases of noise traders, as described in the text below, very plausibly contributed to the dot.com bubble and subsequent crash of 1999–2001. There, however, we emphasized the institutional half of the story. To be sure, noise traders with systematic cognitive biases can distort prices even in very actively traded markets in public equities, but they can only do so occasionally when activity by noise traders is so intense that it short-circuits the arbitrage mechanism, and savvy traders become unable or unwilling to police prices. See, e.g., Andrei Shleifer, Inefficient Markets:

this important literature derives from work by the cognitive psychologists Daniel Kahneman and Amos Tversky, who use experiments to show how common cognitive biases lead individuals to systematically mis-assess value.[83] We will not review our earlier discussion here, much less the additional progress made in behavioral finance since our intervention. We do not doubt, for example, that the failure of CDO purchasers to correctly assess the riskiness of these assets is consistent with a theory of cognitive bias.

Instead we make a different point, one that goes to the plausibility rather than to the consistency of market frictions as the chief culprits in the Subprime Crisis. Unsophisticated investors—noise traders rather than institutional investors—are usually depicted as more vulnerable to cognitive biases, and therefore more likely than professional investors to distort market prices. Charles M.C. Lee, Andrei Shleifer, and Richard

An Introduction to Behavioral Finance 24 (2000). Arbitraging against the sentiment of oblivious noise traders is very risky. It may be more profitable to trade into the bubble they create in the hope of making a quick escape before it bursts. Low cost arbitrage also requires infrastructure such as standardized CDS contracts and the ABX indices. Moreover, other frictions arise when arbitrageurs trade with other people's money because outside investors do not know whether a bad trade reflects bad judgment or only bad luck, and may therefore lose their appetite for more investment. Therefore arbitrageurs have an incentive to be conservative when trading with other people's money. In contrast to our earlier article dealing with the dot.com crisis, however, we argue below that cognitive bias is less likely to have played a central role in the Subprime Crisis where almost all investors were institutions, savvy intermediaries, and professional traders. While some commentators argue that such professional investors are also subject to "distorted beliefs," it is very hard to distinguish this notion with its overtone of cognitive impairment from entirely rational behavior under circumstances of costly information and moral hazard created by informational intermediaries. Economists working in the tradition of behavioral finance recognize the distinction between noise traders that might have played an important role in the dot.com bubble and the sober-minded institutional investors collectively responsible for the Subprime Crisis. Brock Mendel and Andrei Shleifer, for example, offer a clever model of the Crisis in which even small numbers of noise traders might mislead the vast majority of sober-minded investors who are attempting to decode price signals. See Brock Mendel & Andrei Shleifer, Chasing Noise, 104 J. Fin. Econ. 303, 305 (2012). But from our perspective, their model is less about irrational trading than about high information costs that lead investors to rationally misinterpret price signals.

[83] For a collection of their early work, see Daniel Kahneman & Amos Tversky, Judgment Under Uncertainty: Heuristics and Biases (Daniel Kahneman et al. eds., 1982). Nicholas Barberis & Richard Thaler, A Survey of Behavioral Finance, *in* 1 Handbook of the Economics of Finance 1053 (G. Constantinides et al. eds., 2003) and David Hirshleifer, Investor Psychology and Asset Pricing, 56 J. Fin. 1533, 1563–76 (2001) provide recent finance-oriented surveys. Daniel Kahneman's receipt of the 2002 Nobel Prize in Economics for this body of work is dramatic evidence of these psychologists' impact on economics. Because of his untimely death, Amos Tversky was not eligible to share in the Nobel Prize award.

Thaler's clever effort to explain the discount often associated with closed-end mutual funds—one of the long-standing phenomena that conflicts with the implications of the ECMH—aptly illustrates the potential for such misguided investors to influence price efficiency.[84] When an investor sells shares in a closed-end mutual fund, she receives what a buyer is willing to pay, rather than a proportionate share of the fund's net asset value. Because the net asset value of a closed-end fund is observable, the ECMH predicts that fund's stock price will reflect this value. In fact, closed-end funds systematically (but not uniformly) trade at discounts from their net asset values—a longstanding "puzzle" for the ECMH is that stock prices often diverge from asset values in the one case in which these underlying values are observable.[85]

However, noise trading has limited explanatory power in the layered markets that gave rise to the Subprime Crisis. The closest analogues to noise traders during the Subprime Crisis were the house flippers and unfortunate homebuyers who agreed to mortgages they could not afford.[86] For reasons developed earlier,[87] housing prices were unlikely to have reflected the full costs of default risks and liars with any modicum of relative efficiency. At the other end of the CDO production chain, institutional investors purchased AAA CDO bonds in a primary market without real trading to aggregate price-relevant information. Such trading happened only in the intermediate markets in RMBSs and their derivatives. These markets clearly were sensitive to new information bubbling up from the housing market and, in retrospect, plausibly predicted price movements in the other markets as well. Figure 1 below shows

[84] Charles M.C. Lee, Andrei Shleifer & Richard Thaler, Investment Sentiment and the Closed-End Fund Puzzle, 46 J. Fin. 75 (1991). For the heated debate over econometrics incited by Lee, Shleifer, and Thaler, see Nai-fu Chen, Raymond Kan & Merton Miller, Are the Discounts on Closed-End Funds a Sentiment Index?, 48 J. Fin. 795 (1993), Navin Chopra et al., Yes, Discounts on Closed-End Funds are a Sentiment Index, 48 J. Fin. 801 (1993), and Nai-fu Chen, Raymond Kan & Merton Miller, A Rejoinder, 48 J. Fin. 809 (1993). Zingales refers to the closed-end mutual fund phenomenon in his recent account of the challenges to the ECMH. Zingales, supra note 11, at 33–36.

[85] See Reinier Kraakman, Taking Discounts Seriously: The Implications of "Discounted" Share Prices as an Acquisition Motive, 88 Colum. L. Rev. 891, 892 (1988). But even here, the absence of a valuation model makes a difference: For example, shares in closed-end equity funds are frequently less liquid than the widely traded securities that these funds hold. Could liquidity risk be part of the valuation model?

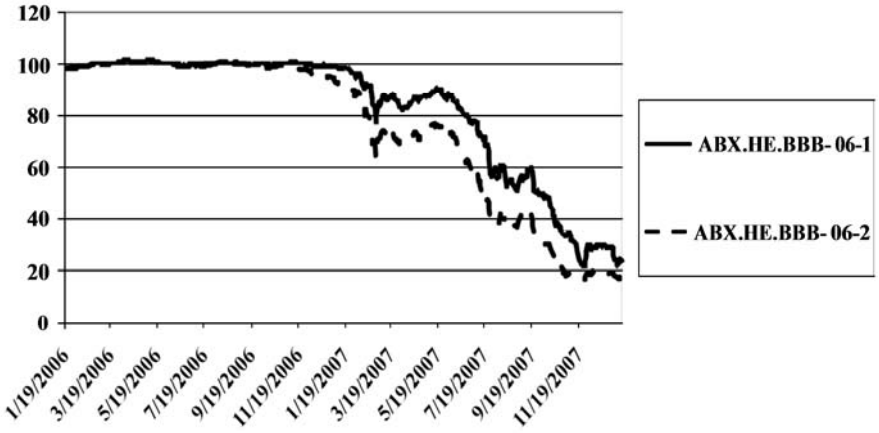
[86] See Hill, supra note 75, at 51–52, for a plausible case that these borrowers made fully rational decisions in buying homes they could not afford with money borrowed—at least for the teaser period—at greatly below market interest rates.

[87] See Wallace, supra note 49, at 44.

prices of the first and second vintages of ABX BBB- indices issued on July 1, 2005 and January 1, 2006.[88] As the graph suggests, the second vintage 2006 of BBB- subprime bonds (ABX.HE.BBB-06-2) fell into decline just five months after trading began and lost twenty percent of its value by March 2007. By way of comparison, most commentators date the onset of the Subprime Crisis to July or August 2007, when the same index had already lost sixty percent of its value.

Note, too, that while some AAA bonds of mezzanine CDOs had lost upwards of fifty percent of their value by the end of 2007, the senior tranches of RMBS bonds retained almost all of their value.

**Figure 1: ABX BBB-Subindex Prices**




The Financial Crisis Inquiry Report reveals that twelve out of America's thirteen most important financial institutions were at risk of failure during 2008, while "[o]verall, for 2005 to 2007 vintage tranches of mortgage-backed securities [i.e., RMBSs] originally rated triple-A . . . only about 10% of [these bonds issued by Alt-A mortgage pools[89]] and 4% of [AAA bonds issued by subprime mortgage pools] had been 'materially impaired'—meaning that losses were imminent or had al-

[88] Figure 1 is taken from Gorton, Information, supra note 51, at 5.

[89] Alt-A mortgages were those otherwise hard to classify and included a large portion of the so-called liar loans, where borrowed claims about critical information such as income and outstanding debt were accepted at face value without verification requirements.

ready been suffered—by the end of 2009."[90] This was not a bad record. Unfortunately, it extended only to senior bonds in the single Crisis-related market where shorting was cheap and sophisticated players traded actively. Without the emergence of CDOs to absorb the junior RMBS bonds, new issuances of RMBSs might have declined, and the Subprime Crisis might have been contained.

## IV. THE POLICY IMPLICATIONS OF A POST-CRISIS ECMH

As we suggested in Part I, a skeptic may dismiss our defense of a modest ECMH in the wake of the Subprime Crisis. Of what policy value is a hypothesis that fails to give strong proactive advice on how to prevent asset bubbles—the market phenomenon at the heart of the Crisis? In response, we have argued that the ECMH, properly understood, can help to locate and reduce market frictions even if it cannot prevent market bubbles. A modest ECMH can be a diagnostic tool for exploring how closely real markets approximate the frictionless ideal. In addition, it may also guide us, if we are very smart, in improving the institutions that contribute to the informational efficiency of market prices, which in turn may help mitigate the effect of bubbles.

This Part tentatively describes how a modest ECMH can inform regulatory strategy. Our ambition is purely illustrative. For us, the most important lesson that both the Internet bubble and the Subprime Crisis teach is the extraordinary sensitivity of markets to the frictions that impede information from informing prices, be these frictions the agency costs of using informational intermediaries, the limitations of certain market structures, or the sheer cost of acquiring information about complex and opaque market instruments and successfully evaluating them.

Further, we argue that increasing the relative efficiency of market prices complements the effectiveness of regulation. Well-designed regulation should seek to increase price transparency, while greater transparency, in turn, should facilitate regulatory effectiveness. In this virtuous circle, greater relative efficiency of asset prices can reveal the success of regulatory intervention—or reveal the failure of disingenuous regulation

[90] Fin. Crisis Inquiry Comm'n, Financial Crisis Inquiry Report 228–29 (2011), available at http://www.gpo.gov/fdsys/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf.

that stems from the negative impact of public sector agency problems on the relative efficiency of market prices.[91]

We illustrate the interaction between markets and regulation by discussing two categories of regulatory responses to the Subprime Crisis, each of which corresponds to a pillar of the ECMH: (1) regulation that affects information costs, and (2) regulation that affects the market's capacity to aggregate and impound information into price.[92] In the first category, two regulatory responses to the Crisis seem to move in the right direction: the Federal Reserve's program of stress testing banks and the Dodd-Frank Wall Street Reform and Consumer Protection Act's ("Dodd-Frank") tentative steps toward increasing mandatory disclosure. A third information-relevant reform that surfaced in the Crisis's wake, however, moved in the wrong direction. This was the (temporary) decision of the Financial Accounting Standards Board ("FASB") to allow financial institutions to relax fair-value accounting standards in valuing financial assets.

With respect to the second pillar of the ECMH, we describe interventions that might encourage information aggregation (through trading and short selling) and address structural reforms intended to increase the visibility of price and trading volume information to traders and market regulators alike. Here, however, we remain agnostic about possible reforms, as befits our limited knowledge about the structure at issue.

### *A. Regulation and Information Costs*

Appropriately, we begin with post-Crisis regulatory interventions that might influence the costs of acquiring, verifying, and valuing information.

#### *1. Expanding Disclosure*

Increased mandatory disclosure is the simplest response to market failure that turns on information costs. Disclosure was inadequate within

[91] This argument parallels that made by Jeffrey Gordon with respect to the role and effectiveness of independent directors. In Gordon's account, the increased informational efficiency of stock prices allowed independent directors to undertake a much more vigorous monitoring role in corporate governance. Jeffrey Gordon, The Rise of Independent Directors in the United States, 1950–2005: Of Shareholder Value and Stock Market Prices, 59 Stan. L. Rev. 1465, 1541 (2007).

[92] See supra Part III (discussing the role of information costs in determining relative informational efficiency and summarizing the mechanisms of market efficiency).

and across all markets implicated in the Crisis: from homebuyers to lenders, from mortgage originators to securitizers, from the issuers of RMBS bonds to the RMBS market, from the sponsors and underwriters of RMBS CDOs to the rating agencies, and, most importantly, from CDO underwriters and rating agencies to the ultimate institutional purchasers of CDO AAA bonds. One of several examples emerges from an empirical study undertaken by the Committee on Capital Markets, which found that only some RMBS issuers provided granular level disclosure about the mortgages behind particular securitizations, and even these issuers failed to include more than a third of the data considered "essential" by more than eighty percent of the sample of institutional buyers of RMBS-backed bonds.[93] Disclosure of dynamic loan-level information prior to the Subprime Crisis was even scarcer.[94]

At the opposite end of the CDO assembly line, disclosure about the assets underlying AAA CDOs was still less forthcoming. Each bespoke CDO included bonds backed by different tranches of numerous RMBSs and even other CDOs. The pooled cash flows from these motley assets were then re-divided (or "restructured") into the CDO's unique scheme of tranches, which governed the "waterfall" of cash flows to its numbered tranches of bonds according to its own complex timing and distribution rules. There was seniority among tranches of course, but it was often quirky seniority arising from the over-collateralization of some tranches and similar modifications. To further complicate matters, CDO managers actively bought and sold portfolio assets within specified limits. As the number of tranches and the variety of CDO assets grew, the information required for a thorough valuation also grew exponentially.[95]

[93] Comm. on Capital Mkts., The Global Financial Crisis: A Plan for Regulatory Reform 146–48 (2009), available at http://www.capmktsreg.org/pdfs/TGFC-CCMR_Report_(5-26-09).pdf.

[94] Id. at 148–50 (reporting that the data available are so voluminous that the database from a single third-party provider contains upwards of one billion rows of data); see Scott Peppet, Smart Mortgages, Privacy and the Regulatory Possibility of Infomediation 11 (Univ. of Colo. Law Legal Studies Research, Working Paper No. 09–13, 2009), available at http://ssrn.com/abstract=1458064 (providing a helpful survey of information problems confronting investors in mortgage-backed securities and derivatives).

[95] John B. Taylor, Getting Off Track: How Government Actions and Interventions Caused, Prolonged, and Worsened the Financial Crisis 13 (2009); Gorton, The Subprime Panic, supra note 51, at 45, 49. Robert Bartlett recounts efforts by one hedge fund to evaluate two monoline insurers' exposure to CDOs. Even though the two insurers had only twenty-eight and thirty direct exposures, after drilling down, the hedge fund determined that each insurer was

Remember too that CDO managers actively bought new assets and sold old ones. From the perspective of the institutional purchasers of CDO-backed bonds, the prospect of actually valuing these bonds from the ground up ranged from impossible to "merely" extraordinarily difficult.[96] But this question was largely moot since "few investors [in CDO bonds] actually went to the trouble [of attempting to analyze them]."[97]

The story of the Subprime Crisis wound down as the real estate market collapsed and the last CDO bonds were placed at the end of 2007. As AAA CDO bonds came to be perceived as risky, other securitized assets did as well. By 2008, no one would buy CDO or even RMBS bonds on the OTC market because no one knew their value. Moreover, the many banks and other financial institutions holding CDOs and RMBSs were forced to write down the value of these assets. Further, collateral calls by CDS holders on CDS writers forced fire sales and additional write-downs of CDOs, ultimately forcing AIG into government ownership and Lehman Brothers into bankruptcy. And so the Subprime Crisis morphed into the broader Financial Crisis. As Nobel laureate Harry Markowitz wrote, "These [AAA CDO] instruments caused an information crisis in which parties refused to enter into transactions with each other whenever

exposed to over 3,000 unique tranches of MBS and over 400 CDOs. Bartlett, supra note 78, at 44.

[96] Comm. on Capital Mkts., supra note 93, at 150. Robert Bartlett's case study of Pershing Square's efforts to short two monoline insurers because of their CDO exposure illustrates the point. Pershing Square went to a great deal of effort to develop an "open source" computer model that valued the insurers' CDO exposure and wrote a number of research reports explaining Pershing Square's negative assessment (and its short position on the insurers' stock). Nonetheless, Pershing Square's model, available to others, and its reports, which proved ex post to be far more accurate than the market's valuation as reflected in the insurers' stock price, failed to trigger widespread shorting of the insurers' stock by professional investors, the drivers of the professionally informed trading mechanism. Bartlett, supra note 78, at 42–48. For our purposes, the central point is that Pershing Square's model was disputed by the insurers, id. at 6–7, was inconsistent with the market, and would have been very difficult and expensive for any other potential arbitrageur to confirm by replicating the model independently. In that circumstance, we would expect the Pershing Square information to be reflected in price only slowly—relatively inefficiently—as the market gradually acquires new information that confirms the general accuracy of the Pershing Square model. Pershing Square plainly was trying to engage the professionally informed trading mechanism by making its model available to all; however, it underestimated the costs of confirming the model's credibility. This is consistent with the information-based barriers to the adoption of new and innovative trading instruments; it takes time for the market to understand and determine the appropriate valuation model. See Gilson & Kraakman, supra note 9, at 585; Awrey, supra note 4, at 43 ("[N]ewer and more innovative financial instruments invariably demand the incursion of high (initial) costs on the part of both market participants and regulators.").

[97] Comm. on Capital Mkts., supra note 93, at 150.

doing so involved counterparty risk because no one knew who held bad paper."[98]

So much for the diagnosis. What about the treatment? From the standpoint of acquiring and verifying information, the ideal treatment might be to assign each mortgage and the RMBS portfolio a unique number that would allow investors at each market level to track the performance of these assets, even when portfolios are updated and assets are bought and sold. The addition of mandatory programs to the waterfalls of cash through the tranches of CDOs and RMBSs might be necessary as well.[99]

But would such a registration regime be worth the candle? There is an enormous political roadblock. A half dozen federal agencies and the private sector would have to cooperate to implement such a thorough disclosure regime. For example, the Securities and Exchange Commission ("SEC") is responsible under the Securities Act of 1933 for disclosures concerning publicly offered instruments in securitized pools, as well as private offerings of such securities, and the circumstances under which periodic reporting under the Securities Exchange Act of 1934 can be terminated with respect to previously registered securitization instruments.[100] The FASB is responsible for the accounting rules that govern

[98] Harry M. Markowitz, Proposals Concerning the Current Financial Crisis, 65 Fin. Analysts J., Jan./Feb. 2009, at 25; see Matthew Pritsker, Informational Easing: Improving Credit Conditions Through the Release of Information, 16 Fed. Res. Bank N.Y. Econ. Pol'y Rev. 77, 82 (2010) ("Interbank spreads increased appreciably because of uncertainty over which banks were exposed to housing—and especially uncertainty over which banks were exposed to subprime loans.").

[99] For useful accounts of the distribution of regulatory authority, see Peppet, supra note 94, at 45–56, and Howell E. Jackson, Loan-Level Disclosure in Securitization Transactions: A Problem with Three Dimensions 5–19 (Harvard Law Sch. Pub. Law & Legal Theory Working Paper Series, Paper No. 10–40, 2010), available at http://ssrn.com/abstract=1649657.

[100] Among other Dodd-Frank sections, §§ 942(a) and (b) address these issues. Pub. L. No. 111-203, 124 Stat. 1376 (2010). Dodd-Frank § 942(a) established an ongoing reporting obligation for issuers of all ABS classes for which a registration statement has become effective pursuant to the Securities Act, and it also allowed the SEC to propose rules providing for the suspension of this duty to file for any class of ABS. Id. Effective September 22, 2011, the SEC adopted rules to provide thresholds for suspension of the reporting requirements for ABS issuers and also amended rules relating to the Exchange Act reporting requirements of ABS issuers. Id. For example, amended Exchange Act Rule 15d–22(b) provides for suspension of reporting obligations for ABS classes in certain circumstances. See 17 C.F.R. § 240.15d–22 (2013). For more detail on the final rule changes, see Suspension of the Duty to File Reports for Classes of Asset-Backed Securities Under Section 15(D) of the Securities Exchange Act of 1934, 76 Fed. Reg. 52,549 (Aug. 23, 2011). Dodd-Frank § 942(b) adds § 7(c) to the Securities Act to require ABS issuers to disclose certain loan-level information

when banks must consolidate securitizations for purposes of their financial statements and, it follows, for purposes of disclosure under SEC rules. The Federal Deposit Insurance Corporation is responsible for regulating the terms of, and disclosure concerning, securitizations undertaken by insured institutions, including consolidation policy for purposes of regulatory review. In the private sector, the American Securitization Forum, a trade group, has proposed disclosure reforms through its Project Restart,[101] which would specify loan-level disclosure and computer-based mechanisms through which this could be traced through fragmentation levels, dramatically reducing the costs of acquiring the information necessary to value MBSs, CDOs and CDSs. Thus, multi-party regulatory and voluntary efforts to improve disclosure must demonstrate considerable promise to overcome their political costs.

Demonstrating such promise is both practically and conceptually difficult. Buyers accepted low returns on AAA bonds because they were presumptively (almost) risk-free assets. As Jean Tirole's recent survey of the literature on illiquidity indicates, there is a tradeoff between returns and the informational demands of fixed income securities.[102] Purportedly safe securities pay low returns precisely because their buyers need not do due diligence beyond reviewing the grades assigned by the rating agencies, that is, third parties assumed to be credible informational intermediaries.[103] But Vi Tri Dang, Gary Gorton, and Bengt Holmstrom show that if subsequent bad news undermines the credibility of the credit raters, the jig is up.[104] Rated securities suddenly become information sensitive, leading to one of three results: their prices drop far enough to restore absolute belief in their safety, their buyers acquire val-

for the assets backing the security for each tranche or class of security. The SEC was tasked with setting standards for the format of data to be provided and with requiring issuers to disclose asset-level or loan-level data. On July 26, 2011, the SEC re-proposed rules requiring this asset-level information, but currently final rules have not been put forth. See Re-Proposed Rule: Re-Proposal of Shelf Eligibility Conditions for Asset-Backed Securities, 76 Fed. Reg. 47,948 (proposed Aug. 5, 2011).

[101] American Securitization Forum, ASF Project Restart: ASF RMBS Disclosure and Reporting Packages (July 15, 2009), http://www.americansecuritization.com/WorkArea/DownloadAsset.aspx?id=6707.

[102] See Jean Tirole, Illiquidity and All Its Friends, 49 J. Econ. Literature 287, 302–03 (2011).

[103] Id. at 302.

[104] See Vi Tri Dang, Gary Gorton & Bengt Holstrom, Ignorance, Debt, and Financial Crises 2–3 (Mar. 11, 2013) (unpublished manuscript) (on file with author), available at http://www.columbia.edu/~td2332/Paper_Ignorance.pdf.

uation skills, or they eventually no longer have buyers and become completely illiquid. Dang et al. conclude that when there is gross failure of informational intermediaries to anticipate bad news "[t]he shock is amplified, leading to a crisis."[105] One implication of this analysis is that the former purchasers of CDO AAA bonds *may not want* an elaborate disclosure system to safeguard against misleading or inflated credit ratings. For them, a superior outcome might be increasing the reliability of credit rating agencies.

Dodd-Frank has already taken a step in this direction by mandating that rating agencies disclose the principal assumptions behind their models even if some details must remain proprietary.[106] Once implemented, such disclosure would presumably expose rating methodologies to careful scrutiny (and to additional gaming as well). Another reform might be to leverage the reputations of agencies by requiring that they periodically report on the aggregate accuracy of their past ratings—a report that might be accompanied by a performance-related award or fine.[107] We cannot hazard a guess as to whether these or other constraints on rating agencies would prove cost effective. The perennial objection is that they could be contracted for if they really were effective, and the perennial response is that without experimentation even the market cannot know value ex ante.

[105] Id. at 3.

[106] On May 18, 2011, the SEC proposed rules containing this requirement. Proposed rule Section 15E(s)(1) of the Exchange Act, for example, requires that NRSROs provide, along with any credit rating, a form containing information relating to the assumptions underlying the credit rating procedures and methodologies and the data that were relied on to determine the credit rating. As of publication, however, final rules have not been promulgated. See Nationally Recognized Statistical Rating Organizations, 76 Fed. Reg. 33,420, 33,456 (proposed June 8, 2011).

[107] For a discussion of possible reforms relating to rating agency accuracy, see Coffee, supra note 45, at 246–71. One potential solution—placing the CRA fee in escrow and entitling investors to "claw back" the fee if the rating proves accurate—could address the issue that the accuracy of the rating is determined only over the long run, while the fee is paid in the short run. Id. at 253. Coffee goes on to consider the merits of using a system where the government chooses a CRA to use, as compared to a system where the CRA rotates. Id. at 256–58. Coffee concludes, essentially, that the former "could degenerate into a means for distributing patronage and political payoffs" and that the latter would provide no incentive for rating agency accuracy. Id. at 257–58. Finally, Coffee considers the merits of a subscriber-pays model, where institutions would have to obtain a credit rating from the CRA of their choosing. Id. at 256–59, 269. He concludes that this model would foster competition and thus put more emphasis on a CRA's reputation for accuracy, but doubts that investors themselves would be willing to pay for a rating. Id. at 258–59.

A final limitation on disclosure as a regulatory strategy is the sheer complexity of some investment instruments. As capital markets grow more complete, financial innovations grow more complex. The ECMH predicts that the price stability of novel securities increases with market experience and improved modeling. We cannot rule out the possibility, however, that the dangers posed by a class of securities cannot be detected or easily rectified by their designers soon enough to prevent financial chaos. In some cases, only strong regulatory controls or outright prohibition may do. If we cannot predict (and prevent) earthquakes, we can at least adopt building codes that make a human catastrophe less likely.

*2. Bank Stress Tests*

It is widely accepted that the transition from the Subprime Crisis to the Financial Crisis occurred with the freezing of the credit markets. Several things occurred at once. The value of senior CDO notes dropped precipitously as they lost their risk-free reputation in the market. Simultaneously, investors and banks realized that little was known about how much exposure individual banks carried to the risks associated with these assets.[108] Banks responded to these epiphanies by sharply reducing lending while increasing the collateral they demanded for new loans. This dramatic decline in bank lending—combined with a similar decline in lending in the shadow banking market—led to a liquidity crisis.[109] Information about the financial conditions of banks remained prohibitively costly until the state intervened to assess the financial health of individual banks.[110]

One part of the Treasury's Financial Stability package announced in January 2008 was directed at producing information about the condition

[108] "Interbank spreads increased appreciably because of uncertainty over which banks were exposed to housing—and especially uncertainty over which banks were exposed to subprime loans." Pritsker, supra note 98, at 82.

[109] "[D]uring the financial crisis of 2007–2009, interbank spreads increased markedly, and lending through the interbank market declined." Id. at 79. Gary Gorton stresses that the lack of information concerning the assets that underlay mortgage-backed securities either held by banks or as to which banks had a residual stake contributed importantly to the uncertainty. Gary Gorton, Slapped by the Invisible Hand: The Panic of 2007, at 62–65 (2010); see also Markowitz, supra note 98, at 25 ("These instruments caused an information crisis in which parties refused to enter into transactions with each other whenever doing so involved counterparty risk because no one knew who held bad paper.").

[110] Pritsker, supra note 98, at 82.

of large U.S. banks. Through the Supervisory Capital Assessment Program ("SCAP," or the "Stress Test"), the Treasury required each of the nineteen largest U.S. banks, representing some two-thirds of all U.S. bank assets,[111] to simultaneously undertake a Treasury-specified assessment of the bank's capital two years into the future under two different scenarios—one baseline and one more adverse—in order to identify whether the bank had sufficient capital under each. The methodology of the Stress Test was publicly disclosed so that its credibility could be independently evaluated.[112] Banks that reported a capital shortfall would be required to raise new capital in that amount, which the Treasury would provide if the market would not. Importantly, the Treasury publicly announced the results of the Stress Test, and the corresponding determination of capital adequacy. The Stress Test revealed that ten of the banks had inadequate capital, while nine had sufficient capital. Of the banks that had to raise new capital, the size of the shortfall ranged from $0.6 billion to $33.9 billion.

From our perspective, the Stress Test resurrected the market in interbank lending by generating new information about the credit worthiness of the largest U.S. banks.[113] Of course, the market itself might have generated the same information more cheaply—but it did not when this information was critical. A recent paper provides evidence of the new information the Stress Test provided.[114] Peristian et al. report the results of

[111] Stavros Peristian, Donald P. Morgan & Vanessa Savino, Fed. Reserve Bank of N.Y., Staff Report No. 460, The Information Value of the Stress Test and Bank Opacity 4 (2010), available at http://www.ssrn.com/abstract=1650670.

[112] See Bd. of Governors of the Fed. Reserve Sys., The Supervisory Capital Assessment Program: Design and Implementation 1–2 (2009), available at http://www.federalreserve.gov/bankinforeg/bcreg20090424a1.pdf.

[113] Daniel K. Tarullo, a Federal Reserve Governor, also appears to have been persuaded that the stress tests provided new information to the market:

> [B]ecause loan portfolios are inherently difficult to value without a great deal of detailed information, increased transparency could be an important addition to the information available to investors and counterparties of the largest institutions . . . . The market discipline made possible by such means as special resolution mechanisms and contingent capital will be most effective if market participants have adequate information with which to make informed judgments about the banks.

Daniel K. Tarullo, Member, Bd. of Governors of the Fed. Reserve Sys., Lessons from the Crisis Stress Tests, Remarks at the Federal Reserve Board International Research Forum on Monetary Policy 9 (Mar. 26, 2010), available at http://www.federalreserve.gov/newsevents/speech/tarullo20100326a.pdf.

[114] See Peristian et al., supra note 111, at 1–4. Other sources provide interview evidence of the value of SCAP disclosed information: "A broad set of market indicators also suggest that the public release of SCAP results may have helped reduce uncertainty in the financial mar-

an event study measuring the stock price response of two categories of the nineteen large U.S. banks that were required to conduct the Stress Test: the ten banks that the Stress Test revealed needed more capital, and the nine banks whose capital the Stress Test showed was adequate. The stock prices of the nine banks the Stress Test showed to have adequate capital experienced no abnormal returns on announcement of the results. The authors interpret this result as consistent with the market previously having identified the banks that were adequately capitalized. For these banks, the Stress Test provided no new information.[115]

In contrast, the stock prices of the ten banks that the Stress Test showed to require significant additional capital experienced significant positive abnormal returns on announcement of their capital deficiency. The authors interpret this as showing that the Stress Test credibly informed the market that banks suspected to be weak were stronger than had been anticipated.[116]

In late 2011, following the Stress Tests, the Federal Reserve Board finalized a rule requiring U.S. bank holding companies with consolidated assets of $50 billion or more to submit annual capital plans for review in a program known as the Comprehensive Capital Analysis and Review ("CCAR").[117] The stress testing under CCAR is conducted annually.

kets and increased market confidence." U.S. Gov't Accountability Office, GAO–10–861, Bank Stress Test Offers Lessons as Regulators Take Further Actions to Strengthen Supervisory Oversight 23 (2010).

[115] Peristian et al., supra note 111, at 14.

[116] See Peristian et al., supra note 111, at 15 (noting that abnormal returns were important for SCAP banks, but trivial for the next fifty). Daniel K. Tarullo, a Federal Reserve Governor, made the point directly:

> [T]he [SCAP] results were released at a time when uncertainty about bank conditions were very high, and some market participants feared the worst. That is, perceptions of tail risk were very high, and the SCAP results helped reassure market participants that under a severe but plausible scenario, the capital needs of the largest U.S. banks were manageable.

Tarullo, supra note 113, at 4–5. Frederic S. Mishkin, another Federal Reserve Governor, reached the same conclusion: "The stress tests were a key factor that helped increase the amount of information in the marketplace, thereby reducing asymmetric information and adverse selection and moral hazard problems." Frederic S. Mishkin, Over the Cliff: From the Subprime to the Global Financial Crisis, 25 J. Econ. Persp. 49, 62 (2010).

[117] Press Release, Fed. Reserve Bd. (Nov. 22, 2011), available at http://www.federalreserve.gov/newsevents/press/bcreg/20111122a.htm. In 2012, the CCAR was required for the same nineteen bank holding companies that had participated in SCAP, plus twelve additional firms with at least $50 billion in assets that had not previously participated in stress testing. Id. In 2013, one of the nineteen bank holding companies, MetLife, Inc., did not participate because it was in the process of deregistering as a bank holding

Each bank holding company's capital plan must include detailed descriptions of: "the [holding company's] processes for assessing capital adequacy; the policies governing capital actions such as common stock issuance, dividends, and share repurchases; and all planned capital actions over a nine-quarter reporting horizon."[118] In addition, each holding company must report to the Federal Reserve the results of various stress tests that assess the sources and uses of capital under both baseline and stressed economic conditions.[119]

The first CCAR results, released on March 13, 2012, were promising. The stress scenario included a peak unemployment rate of thirteen percent, a fifty percent drop in equity prices, and a twenty-one percent decline in housing prices, which would result in losses at the nineteen bank holding companies totalling $534 billion.[120] Despite these heavy hypothetical losses, fifteen of the nineteen bank holding companies were estimated to maintain capital ratios above the regulatory minimum levels, even when accounting for proposed capital actions like dividend increases or share buybacks.[121]

An addition to the Federal Reserve's stress testing regime came in October 2012 when it finalized the Dodd-Frank stress test, which is similar to but distinct from the CCAR capital adequacy test.[122] The Dodd-Frank stress test implemented Dodd-Frank sections 165(i)(1) and (i)(2), which required both supervisory and company-run stress testing over a wider set of institutions than those covered by the CCAR.[123] Institutions subject to the Dodd-Frank stress test include those bank holding companies with assets of $50 billion or more that had participated in SCAP (and who had also participated the previous year in CCAR), as well as bank holding companies with between $10 billion and $50 billion in assets, and state member banks and savings and loan holding companies

company when the 2013 process began. Bd. of Governors of the Fed. Reserve Sys., Comprehensive Capital Analysis and Review 2013: Assessment Framework and Results 9 n.10 (2013) [hereinafter Assessment Framework], available at http://www.federalreserve.gov/newsevents/press/bcreg/ccar-2013-results-20130314.pdf.

[118] Tarullo, supra note 113, at 3.

[119] Id.

[120] Press Release, Fed. Reserve Bd. (Mar. 13, 2012), available at http://www.federalreserve.gov/newsevents/press/bcreg/20120313a.htm.

[121] Id.

[122] Press Release, Fed. Reserve Bd. (Oct. 9, 2012), available at http://www.federalreserve.gov/newsevents/press/bcreg/20121009a.htm.

[123] Assessment Framework, supra note 117, at 10.

with over $10 billion in assets.[124] The main difference between the CCAR and the Dodd-Frank stress tests is the capital action assumptions that are combined with pre-tax net income projections to estimate post-stress capital levels.[125] The Dodd-Frank test uses a standard set of capital action assumptions that are laid out in the Dodd-Frank test rules, while the CCAR analysis uses the bank holding company's planned capital actions to determine whether the company would meet supervisory expectations for capital minimums in stressful economic conditions.[126]

For the institutions that had participated in SCAP, the results of the CCAR and Dodd-Frank stress tests were publicly disclosed in March 2013.[127] The Federal Reserve approved the capital plans of fourteen of the financial institutions, conditionally approved the plans of two more—which must be resubmitted for approval later in 2013—and objected to the plans of the final two, which must be resubmitted after correcting any deficiencies.[128] The remainder of the companies subject to stress testing under the Dodd-Frank requirements were not required to conduct their first stress tests until the fall of 2013 and will not have to publicly disclose results of that test.[129]

Despite the success of SCAP and the subsequent stress tests, there is still debate over the merits of publicly disclosing the stress test results of individual banks. Some banks object because they fear that, in normal times when confidence in the banking system is not in jeopardy, public disclosure of the capital needs of individual banks may result in runs on weaker banks or in a competitive disadvantage that will prevent weaker banks from earning their way out of capital shortages.[130] Commentators

[124] Bd. of Governors of the Fed. Reserve Sys., Dodd-Frank Act Stress Test 2013: Supervisory Stress Test Methodology and Results 3 nn.7–8 (2013) [hereinafter Supervisory Stress Test], available at http://www.federalreserve.gov/bankinforeg/stress-tests/dodd-frank-act-stress-testing.htm.

[125] Assessment Framework, supra note 117, at 5.

[126] Id.

[127] See Supervisory Stress Test, supra note 124; Assessment Framework, supra note 117, at 4.

[128] Press Release, Fed. Reserve Bd. (Mar. 14, 2013), available at http://www.federalreserve.gov/newsevents/press/bcreg/20130314a.htm.

[129] Press Release, Fed. Reserve Bd., supra note 122.

[130] U.S. Gov't Accountability Office, supra note 114, at 42; see Itay Goldstein & Haresh Sapra, Should Banks' Stress Test Results Be Disclosed? An Analysis of the Costs and Benefits 2 (Apr. 2, 2012) (unpublished manuscript prepared for Committee on Capital Markets Regulation) (on file with author), available at http://finance.wharton.upenn.edu/~itayg/Files/stresstests.pdf; see also Tarullo, supra note 113, at 9 (arguing that disclosure may be unnecessarily destabilizing).

echo this fear as well, noting that market participants' ex post reactions to stress test results may not be efficient.[131] Participants may put more weight than is warranted on the public disclosure (in turn reducing the weight they place on their own valuable private information) because the disclosure provides information not only about the banks' health but also about how other market participants may react, which in turn will influence how they react.[132]

Our relative efficiency perspective, however, makes us skeptical of these arguments. Frequent and repeated stress tests would inform the market of the capital deficiencies of banks in time to allow management to address the capital gap well short of the point at which it might initiate a bank run. Such tests would also provide regulators with early warnings of conditions they could better address sooner rather than later. In contrast, hiding capital weakness in the hope it will go away serves neither to discipline the bank managers who have placed their banks in that position,[133] nor to force the attention of the regulators on the problem. It also misleads the public, whose funds are deposited in these institutions and who may have invested in the institutions' securities. We think the lesson of a relative market efficiency assessment counsels powerfully in favor of continued transparency.[134]

[131] Goldstein & Sapra, supra note 130, at 27.

[132] Id. at 18. Goldstein and Sapra discuss two other negative effects that could come from increased disclosure (possible sub-optimal decisions of banks ex ante, and a reduction in traders' incentives to gather information) but conclude that disclosure would be beneficial on the whole because it would promote financial stability. Id. at 8, 24, 29. Til Schuermann agrees that disclosure may disincentivize market participants from generating private information and trading on it, and thus proposes an intermediate disclosure solution. Now that trust in the banking system has been somewhat regained, Schuermann proposes disclosing stress test results in the aggregate in order to provide the market with information while maintaining an incentive for market participants to gather information. Til Schuermann, Stress Testing Banks 19 (Feb. 13, 2013) (unpublished manuscript), available at http://fic.wharton.upenn.edu/fic/papers/12/12-08.pdf.

[133] Indeed, it would operate in the opposite direction. Allowing management of an undercapitalized bank more time to "earn" its way out of a capital deficit is to allow management (and shareholders) to increase the value of their out of the money option by lengthening its term. The same analysis suggests that the time would be used to increase the riskiness of the bank's assets.

[134] Financial commentators agree that rigorous and transparent stress testing was a critical aspect of the recovery of the banking system in the United States after 2009. Correlatively, there is widespread concern today that insufficiently rigorous and transparent testing will cost the E.U. banking system and broader economy dearly in 2014 and beyond. See, e.g., Sam Fleming & Patrick Jenkins, Unanswered Questions Hang Over Euro Bank Tests, Fin. Times (Oct. 23, 2013, 7:23 PM), http://www.ft.com/cms/s/0/85ddc416-3c00-11e3-9851-

*3. A Bad Intervention: Relaxing Fair Value Reporting Standards*

The Treasury Department's and Federal Reserve Board's stress tests had the explicit goal of providing to the market credible new public information concerning the financial condition of large U.S. banks. In contrast, the FASB's Financial Crisis-motivated expansion of a bank's discretion over the balance sheet values assigned to financial assets was the stress tests' evil twin; it reduced the amount, credibility, and usefulness of accounting information available to the market. The Treasury Department rejected the argument that public disclosure of the real capitalization of banks would worsen the Financial Crisis. The FASB made a different choice.

Understanding how the FASB relaxed the requirements of fair value accounting in April 2009 requires a brief description of the framework at that time for valuing assets under U.S. generally accepted accounting principles ("GAAP").[135] For purposes of assessing the impact of accounting rules on financial institutions, the critical starting point is accounting for loans as set forth under Statement of Financial Accounting Standards ("SFAS") 115;[136] in general, loans are the largest category of large U.S. financial institutions' balance sheet assets.[137] Under SFAS 115, accounting for loans differs depending on whether the loans are held for sale or held for investment—that is, depending on the expectation that the loan will be held until maturity. Loans held for sale, for example loans being warehoused before being securitized, are carried at fair value. A loan held for investment is carried at the lower of fair value or amortized cost, with a write-down to fair value required if the loan's value drops below cost. Loans held for investment are the most signifi-

00144feab7de.html (stating that U.S. stress tests of 2009 are the "gold standard" and the European Central Bank should "measure up to the U.S. precedent" despite opposition from banks and Member States, or face serious economic consequences).

[135] International Financial Accounting Standards approach these questions in a broadly similar way. Discussion of these standards is beyond the scope of our effort here.

[136] Fin. Accounting Standards Bd., Statement of Financial Accounting Standards No. 115 (1993), at 5. SFAS 115 is now codified as Accounting Standards Codification ("ASC") Topic 320.

[137] U.S. Sec. & Exch. Comm'n, Report and Recommendations Pursuant to Section 133 of the Emergency Economic Stabilization Act of 2008: Study on Mark-To-Market Accounting 104 (2008), available at http://www.sec.gov/news/studies/2008/marktomarket123008.pdf; Christian Laux & Christian Leuz, Did Fair Value Accounting Contribute to the Financial Crisis?, 24 J. Econ. Persp. 93, 98 (2010) ("'Loans and leases' are by far the most important asset class for bank holding companies and generally account for half or more of these banks' total assets.").

cant asset class on U.S. banks' balance sheets, representing fifty-eight percent of balance sheet assets at the end of the first quarter of 2008.[138]

This brings us to SFAS 157, entitled "Fair Value Measurements."[139] SFAS 157 does not in itself require the application of fair value accounting to any class of assets. Rather, it specifies the manner in which fair value is determined for assets, like loans held for sale rather than for investment (to maturity), that other accounting standards prescribe be carried at fair value.[140]

SFAS 157 defines fair value as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."[141] So far, matters are clear enough. When there are a large number of arm's length transactions involving identical assets, determining fair value is mechanical. But what happens when frequency of transactions and the value of subprime mortgages and related derivatives drop precipitously, as was the case with these instruments? For purposes of financial statement presentation, the questions were: By how much did the value of these assets drop and how would the drop be shown on bank balance sheets? Because of the freeze-up in the credit markets,[142] the banks believed that the limited number of observable market transactions were at unrealistically low prices—that is, that the fundamental values of these loans were higher than the price that could be obtained in the market under crisis

[138] U.S. Sec. and Exch. Comm'n, supra note 137, at 104 n.145.

[139] Fin. Accounting Standards Bd., Accounting Standards Update No. 2011-04, Fair Value Measurement (Topic 820): Amendments to Achieve Common Fair Value Measurement and Disclosure Requirements in U.S. GAAP and IFRSs 162 (2011), available at http://www.fasb.org/cs/BlobServer?blobcol=urldata&blobtable=MungoBlobs&blobkey=id&blobwhere=1175822486936&blobheader=application/pdf.

[140] Fin. Accounting Standards Bd., Statement of Financial Accounting Standards No. 157: Fair Value Measurements (2006). SFAS 157 is now codified as ASC Topic 820. See Fin. Accounting Standards Bd., supra note 139. In May 2011, the International Accounting Standards Board ("IASB") and FASB worked together to update Topic 820 through International Financial Reporting Standards ("IFRS") No. 13. The updated Topic 820, like SFAS 157, does not require the use of fair value accounting, but instead provides guidance on its application. See News Release, Fin. Accounting Standards Bd., FASB, IASB and FASB Issue Common Fair Value Measurement and Disclosure Requirements (May 12, 2011), available at http://www.fasb.org/cs/ContentServer?pagename=FASB/FASBContent_C/NewsPage&cid=1176158544944.

[141] Fin. Accounting Standards Bd., supra note 140, ¶ 5. This definition remained consistent in the Accounting Standards Update to Topic 820. See Fin. Accounting Standards Bd., supra note 139, at 196.

[142] See supra note 98 and accompanying text.

conditions. Did the loans have to be valued at the price for which they could be sold at the moment, or could banks exercise judgment in valuing the assets for balance sheet purposes?

Proponents of suspending or relaxing the application of SFAS 157 during the Financial Crisis typically identified bank regulation as the link between accounting valuation methods and real economic consequences.[143] In this account, balance sheet values are the inputs into the bank supervisor's calculation of capital adequacy. A write-down of loan (asset) values results in increased bank leverage. To satisfy capital requirements, banks would then be forced to reduce leverage by selling loans or other assets at, in their view, artificially low prices. In turn, increased sales into a barely functioning market would further reduce market prices, which would set off another round of sales as other banks marked their loans to the new market. The problem was said to have systemic effects because asset sales by one bank would result in reduced asset values for other banks, causing a system-wide reduction in bank capital. This reduction, in turn, would reduce the financial system's capacity to make loans, thereby deepening the recession.

The FASB responded to the political pressure by easing the application of SFAS 157 in two ways. First, it loosened the standards under SFAS 115 that governed when an asset would be treated as held for investment and therefore carried at historical cost rather than at fair value. Second, its relaxation of SFAS 157 increased a company's discretion to move assets into Level 3, where assets could be "marked-to-model" in the absence of reliable market price information. The result was a considerable increase in the discretion of financial institutions to determine the fair value of their balance-sheet assets.[144]

[143] See Laux & Leuz, supra note 137, at 95 ("The most commonly suggested and most plausible mechanism through which fair-value accounting could contribute to a financial crisis involves the link between accounting and bank capital regulation."); Richard A. Epstein & M. Todd Henderson, Do Accounting Rules Matter? The Dangerous Allure of Mark to Market, 36 J. Corp. L. 513, 513 (2011). For theoretical models of how fair value accounting could affect real performance, see, for example, G.H. Plantin, H. Sapra & H.S. Shin, Marking-to-Market: Panacea or Pandora's Box?, 46 J. Acct. Res. 435, 437 (2008).

[144] Laux & Leuz, supra note 137, at 109. See generally Fin. Accounting Standards Bd., Staff Position No. FAS 157-4, Determining Fair Value When the Volume and Level of Activity for the Asset or Liability Have Significantly Decreased and Identifying Transactions That Are Not Orderly (2009), available at http://www.fasb.org/cs/ContentServer?pagename=FASB%2FDocument_C%2FDocumentPage&cid=1176154545450 (detailing that even if there had been a decrease in the level of activity for assets or liabilities, the objective of a fair value measurement is the same).

Proponents of the changes argued that improving relative market efficiency by disclosure also comes at a heavy cost: Decreasing financial institutions' forward capital on the books results in contagion effects and increases the likelihood of a recession. The Subprime Crisis demonstrates that increasing relative efficiency is just not worth the costs. But three important weaknesses, two empirical and one analytical, undermine this argument.

The first empirical point is straightforward—banks had too few loans actually subject to SFAS 157 to make any difference.[145] A number of empirical studies strongly suggest that SFAS 157 had no impact on the Financial Crisis. For example, at the close of the first quarter of 2008, the SEC 133 Study found that thirty-one percent of total bank assets were subject to fair value accounting under SFAS 157.[146] However, virtually all of these assets (twenty-nine percent of total assets) were investment assets, trading assets, or derivatives. Thus, the overwhelming percentage of loans, including especially subprime loans, were carried at historical cost, and were not subject to fair value adjustment unless they became impaired. Financial institutions may have sold assets during the credit crisis, but fair value accounting did not cause their sale, and therefore did not cause contagion.

The second empirical problem is that the evidence suggests that companies will take advantage of discretion over balance sheet values to overstate the carrying value of assets. Christian Laux and Christian Leuz report two examples of circumstances in which banks appear to have exercised discretion to overstate asset values when accounting standards permitted them to do so. The first example is the reluctance of banks to write down the goodwill created by past acquisitions of other banks. "[O]f the 50 U.S. banks that made substantial acquisitions prior to the financial crisis, 35 banks have not written down their goodwill positions

[145] For example, Peter Wallison argues that SFAS 115 was too restrictive in allowing a company to treat a loan as held to maturity, with the result that it was subject to SFAS 157. Peter J. Wallison, Fair Value Accounting: A Critique, AEI Online (July 28, 2008), http://www.aei.org/outlook/28389. Sanders Shaffer notes, however, that as of the close of the first quarter of 2008, only a total of twelve percent of bank loans were classified as either held for sale or held for investments. Sanders Shaffer, Fair Value Accounting: Villain or Innocent Victim 12 (Fed. Reserve Bank of Bos. Quantitative Analysis Unit, Working Paper No. QAU10-1, 2010), available at http://www.bostonfed.org/bankinfo/qau/wp/2010/qau1001.htm; see also Mary E. Barth & Wayne R. Landsman, How did Financial Reporting Contribute to the Financial Crisis? 19 Eur. Acct. Rev. 399, 405–07 (2010) (arguing that fair value-related charges apply to a limited number of banks).

[146] U.S. Sec. and Exch. Comm'n, supra note 137, at 47.

at all, despite the fact that banks' market values have declined precipitously in the crisis."[147] The second example involves banks' estimates of losses for loans that, because they were expected to be held to maturity, were carried on the balance sheet at historical cost. SFAS 107 nonetheless requires that the fair value of these loans be disclosed in the footnotes. Laux and Leuz find that the difference between the loans' amortized cost and fair value was very much larger than the loss reserves established by the banks.[148] Harry Huizinga and Luc Laeven, too, find that banks overstated the value of real estate loans during the crisis since they were held on the balance sheet at cost.[149]

The analytic problem with the argument against fair value accounting is equally compelling. It is this: Fair value analysis identifies bank supervisory capital requirements as the link between accounting disclosure and the asset sales that are said to trigger a cascade of capital reductions, additional asset sales, and reductions in lending. As accounting scholars have stressed, however, this syllogism is incorrect, both normatively and positively. As a normative matter, capital requirements are set by agencies for the purpose of bank regulation, not for use by investors.[150] As the SEC stated in its recent study, "[f]inancial reporting is intended to meet the needs of investors. While financial reporting may serve as a starting point for other users, such as prudential regulators, the Staff recommends that U.S. GAAP should continue to be developed to satisfy the needs of investors."[151] Like public stress tests, accounting standards that increase relative efficiency illuminate financial circumstances that financial regulators should address. Additionally, observability serves to allocate political responsibility. Investor-focused accounting standards that reveal capital deficits also force financial regulators to take political responsibility for extending regulatory forbearance rather than burying

[147] Laux & Leuz, supra note 137, at 111. For example, the authors report a study showing that Bank of America carried on its balance sheet $80 billion in goodwill, amounting to more than fifty percent of its equity, largely as a result of bank acquisitions, such as Fleet Boston, MBNA, and LaSalle Bank, between 2004 and 2007. As late as the second quarter of 2009, Bank of America had not recorded any reduction in the value of goodwill despite the requirement that the value of goodwill created by an acquisition be assessed every year.

[148] Id. at 114.

[149] Harry Huizinga & Luc Laeven, Bank Valuation and Accounting Discretion During a Financial Crisis, 106 J. Fin. Econ. 614, 615, 621 (2012).

[150] Barth & Landsman, supra note 145, at 407 ("[I]t is the responsibility of bank regulators, not accounting standard setters, to determine how best to mitigate the effects of procyclicality on the stability of the banking system.").

[151] U.S. Sec. and Exch. Comm'n, supra note 137, at 206.

the problem under opaque accounting standards such as historical cost. Thus, separating accounting standards from regulatory standards makes financial regulators politically accountable for their decisions.

In short, the FASB's relaxation of fair value accounting rules in response to political pressure gets it backward. Accounting standards should increase relative informational efficiency, which calls for strengthening, not relaxing, the disclosure of market valuations. As accounting scholars Mary E. Barth and Wayne R. Landsman conclude, "transparency of information associated with measurement and recognition of accounting amounts relating to, and disclosure of information about, asset securitizations and derivatives likely were insufficient for investors to assess properly the values and riskiness of affected bank assets and liabilities."[152] Matters of prudential regulation, including especially regulatory decisions that relax capital requirements in the cause of macroeconomic goals, should be transparent and subject to political accountability.

### *B. Market Structure and Price Efficiency*

If lower information costs are one pillar of efficient asset prices, smoothly functioning trading markets are the other. As Part III indicated above, overlaying a primary market on an actively traded secondary market may, by accident or design, dissipate the value of the information already aggregated by the underlying secondary market. This was one structural problem that arose in the Subprime Crisis. The second problem of market structure was pervasive reliance on OTC or bilateral markets and bespoke assets, both of which hampered the aggregation and distribution of market-wide price and volume information. When viewed from an ECMH perspective, both of these problems suggest more or less obvious solutions. Again, the key questions are whether the suggested solutions are cost effective and whether they require regulatory intervention.

#### *1. Trading in Proxy Instruments*

Commentators on the Subprime Crisis generally agree that the introduction of mortgage-backed securities markets hastened the eventual

[152] Barth & Landsman, supra note 145, at 401.

collapse of the housing bubble.[153] As described in Part III, two derivative products facilitated hedging and shorting mortgage-backed securities. In chronological order, the first was CDS protection, which entered the RMBS market in tradable form in mid-2005.[154] (By contrast, CDS protection written on specific CDOs was a one-off deal invisible to the larger market.) The second shorting and hedging instrument encompassed the ABX subprime indices that began to trade on an open exchange in January 2006. Following Geanakoplos and Gorton, we believe that trading in these derivatives made a large difference. Something had to pop the bubble, and it was already too late for a soft landing by the time that these derivative markets had emerged.

Although Geanakoplos and Gorton see the auxiliary markets as accelerating the end of the bubble in different ways, both stress their importance in impounding new information into RMBS prices. For Geanakoplos, financial institutions such as AIG, Lehman Brothers, Goldman Sachs, and other investment banks turned the switch by aggressively selling CDS protection on RMBSs in 2005[155] and bespoke protection on CDOs shortly thereafter. The customers for these derivatives were hedge funds, arbitrageurs, and even issuers of CDOs themselves who sought to hedge exposure to the inventories of mortgage-backed securities still on their shelves. According to Geanakoplos, "[b]y buying [CDS protection], the pessimists *for the first time* could leverage their negative views about bond prices and . . . *actively push bond prices down.*"[156] In Geanakoplos's view, the full force of CDS protection emerged only as the numbers of contracts grew and market sentiment

[153] See, e.g., Ferrell & Saha, supra note 81, at 98; Gorton, supra note 57, at 10; Geanakoplos, supra note 46, at 110.

[154] Geanakoplos, supra note 46, at 113; see also Ana Fostel & John Geanakoplos, Tranching, CDS, and Asset Prices: How Financial Innovation Can Cause Bubbles and Crashes, 4 Am. Econ. J. Macroeconomics 190, 191–93 (2012) (noting that in 2005, credit default swaps were standardized for mortgages vis-à-vis CDS).

[155] Geanakoplos, supra note 46, at 113–14, speaks of standardized CDSs, but it is uncertain when true standardized CDSs first became a force in the mortgage bond market. It may not have been before the appearance of index-based CDSs in 2008.

[156] Id. at 111 (emphasis added); accord Luigi Zingales, Credit Default Swaps on Trial, Project Syndicate (Apr. 19, 2010), http://www.project-syndicate.org/commentary/credit-default-swaps-on-trial; see also Fostel & Geanakoplos, supra note 154, at 194, 212–14 (arguing that "[t]he underlying bond-asset is not tranched, but people can leverage their purchases of it"). Wallace, supra note 49, at 34–35, argues that because of the demand for insurance, the drop in prices caused the instruments to trade at levels that overstated the default risk on the underlying mortgages.

slowly shifted, first against RMBS optimists and later against structured mortgage-backed bonds generally. In this story, the good news is that the bubble burst sooner than it would have otherwise. The bad news is that the bursting bubble devastated the sellers of CDS protection, such as AIG and Lehman Brothers. Nevertheless, "[h]ad the CDS market for [RBMSs] been around from the beginning, asset prices might never have gotten so high [in the first place]."[157]

As we suggested in Part III, we favor Gary Gorton's emphasis on information aggregation in the ABX market as the most powerful factor channeling information about deteriorating housing prices into subprime RMBS bonds, and—inevitably after a lag—eroding demand for AAA bonds collateralized by CDOs that were heavily invested in lower-tranche RMBS bonds. But regardless of the relative importance of these mechanisms, the point is that innovative securities eventually gave birth to derivatives that forced them to face up to bad news as well as good news. The typical lags in securities development—the introduction of the security first and the shorting vehicle six months later—suggest that a regulator might intervene proactively to balance the reflection of information into the prices of innovative securities when market makers seem sluggish to act on their own. Regulators might scrutinize rapidly expanding markets in innovative securities—for example, the market in securitized mortgage-backed securities—with a practical sense that not all components of an efficient market inevitably fall into place at once. Here, regulators can borrow from the playbook of market makers such as Markit, the developer of the ABX index, by encouraging auxiliary markets in which proxies can be traded and market-wide information revealed. Chances are that market makers will not need much encouragement to police the relative price efficiency in fast-growing trading markets. Perhaps regulatory encouragement and favorable publicity are all that is needed.

An innovative but opaque primary market, however, seems like a different animal. Here there is little or no information aggregation through trading. As a thought experiment, consider what might have occurred if underwriters of mortgage-backed CDOs had been required to meet minimal standardization requirements in 2005 and a private market platform

[157] Geanakoplos, supra note 46, at 113; see also Fostel & Geanakoplos, supra note 154, at 216–17 (detailing that the price crash is much larger in CDS economies than in no CDS economies).

(such as Markit) had been invited to initiate trading in indices that referenced individual tranches of the twenty largest CDOs issued in a given period. One suspects that the sophisticated traders in the RMBS market would soon have turned to shorting the AAA tranches of subprime mezzanine CDOs. In turn, the falling prices of the CDO indices might have raised a red flag large enough to stir anxiety among even the most staid institutional purchasers of these supposedly minimal-risk, fixed-return bonds. And maybe, just maybe, the information would have caused the regulators to notice the growing importance of the shadow banks.[158] If the handwriting was not yet on the wall, the falling prices of AAA CDO bond indices might have written it there, perhaps a full six months before the last AAA bonds were placed prior to the worst of the actual Subprime Crisis.

*2. Redesigning Market Structure*

Engineering unconventional auxiliary markets raises questions of need and feasibility; reengineering existing markets to better inform regulators raises even more difficult questions of policy and political economy. Academics and policymakers have intensely debated the wisdom of Dodd-Frank's mandate to standardize derivatives (such as CDS contracts) and shift their trading from traditional OTC markets to clearinghouse markets (termed the "central clearing counterparties" or "CCPs" in the literature).[159] In a CCP market, the CCP itself is the counterparty to both buyers and sellers.[160] We do not address here the technical aspects of such markets, or their effects on containing counterparty trading risk, which loom large in the policy debate. Following our focus

[158] See Gorton, supra note 56, at 157 (stressing the role of shadow banking in the transformation of the Subprime Crisis into the Financial Crisis and the role played by the regulators' lack of information about the shadow banks).

[159] See, e.g., John Hull, CCPs: Their Risks, and How They Can Be Reduced, 20 J. Derivatives 26, 26 (2012). For a discussion on how CCPs should be regulated to avoid excessive systemic risk, see Darrell Duffie, Replumbing Our Financial System: Uneven Progress, 9 Int'l J. Cent. Banking 251, 253, 266–73 (2013). For concerns about central clearinghouses failing and becoming the next government-sponsored enterprises, see Viral V. Acharya et al., Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance 378–79 (2011). For an argument on central clearing's ability to lower the financial system's cost of providing derivatives to hedge risks, see John E. Parsons, Hit or Miss: Regulating Derivative Markets to Reduce Hedging Costs at Non-Financial Companies 2 (2012), available at http://dspace.mit.edu/bitstream/handle/1721.1/76235/2013-002.pdf.

[160] See, e.g., Darrell Duffie & Haoxiang Zhu, Does a Central Clearing Counterparty Reduce Counterparty Risk?, 1 Rev. Asset Pricing Stud. 74, 74 (2011).

on the ECMH, our concern here is with the relative informational advantages of OTC and the CCP market structures.

One informational advantage claimed for the CCP model does involve counterparty risk, however. A CCP market structure would prevent regulatory surprises such as the horrific discovery that AIG was rapidly facing insolvency as a result of extending CDS protection to a large fraction of the mortgage-backed bond industry. A CCP structure, in other words, would have alerted regulators and the mutual owners of the CCPs themselves to rapid expansions and concentrations of purchases and sales of CDS protection.[161] In addition, a CCP structure would create a second important informational benefit by providing market transparency and automatically generating low-cost information about aggregate market prices and trading volume.[162] This, it is argued, would markedly increase the informational efficiency of the derivative markets.

Curiously, however, the need for information to ensure rational pricing and avoid moral hazard is also the most plausible information-based argument *against* the CCP model.[163] CCP critics argue that shifting the risk for counterparty losses from individual traders to the CCP as a whole would diminish trader incentives to investigate the solvency of their counterparties. This would subject a CCP market to both moral hazard and potential adverse selection problems. The only way the CCP could counter these problems would be to increase collateral requirements and tighten the rules screening out classes of potential counterparties. These protective measures, it is argued, would raise CCP transaction costs well above the purported informational benefits of the CCP regime. In addition, a collective failure to gather sufficient information about counterparties would deprive traders of the information necessary to make the most economical allocations of counterparty risks. Hence trades would be less accurately—and hence less efficiently—priced.[164]

[161] Darrell Duffie, Ada Li & Teo Lubke, Fed. Reserve Bank of N.Y., Staff Report No. 424, Policy Perspectives on the OTC Derivatives Market Infrastructure 17 (2010).

[162] Id.

[163] E.g., Alistair Milne, OTC Central Counterparty Clearing: Myths and Reality, 5 J. Risk Mgmt. Fin. Institutions 335, 339–40 (2012); Craig Pirrong, CATO Inst., The Inefficiency of Clearing Mandates 3–4 (2010), available at http://www.cato.org/sites/cato.org/files/pubs/pdf/PA665.pdf.

[164] Pirrong, supra note 163, at 10–11; see also Craig Pirrong, The Economics of Central Clearing: Theory and Practice 13–14 (ISDA Discussion Papers Series, Paper No. 1, 2011), available at http://www2.isda.org/attachment/MzE0NA==/ISDAdiscussion_CCP_Pirrong.pdf (arguing that risk sharing mechanisms can distort incentives when there are information imperfections).

Regulators would sacrifice existing OTC markets in a misguided attempt to reduce systemic risk and generate aggregate market information.

Although this is a very crude account of the actual policy debate, it suffices to make the point that various dimensions of information costs are as important to evaluating single-level market reforms as they are to addressing information cost issues in multi-layered markets.

## CONCLUSION

This Article assesses the prominent post-Crisis claim that the mispricing in the securities markets related to the Subprime Crisis demonstrates, once and for all, the bankruptcy of the Efficient Capital Market Hypothesis itself. We argue here, as we have previously, that the ECMH efficiency is best understood as a theory about relative efficiency with which public information is reflected in market prices. In the perfect market of finance theory, all information is instantly reflected in prices that are fundamentally as well as informationally efficient. In real capital markets with active secondary trading, prices generally reflect public information rapidly—albeit not instantaneously. Information that is "private" or costly to acquire enters price more slowly and sometimes not at all. Similarly, prices in markets without an effective arbitrage mechanism incorporate public information very slowly. These include primary markets, markets for informationally insensitive securities, and markets dominated by noise traders.

During the Subprime Crisis, multiple institutional frictions impeded relative efficiency to varying degrees in the markets most closely associated with mortgage-backed securities. First, the critical information was extremely costly to acquire: The evidence strongly indicates that few investors had real knowledge in 2005 and early 2006 that housing prices would collapse during 2007. If the existence of a real estate bubble was widely recognized, the timing of its collapse was not. And even if the timing of a drop in housing prices had been known with some certainty, assessing the implications for default risks and prices in the associated securities markets was costly information to acquire, particularly in the case of the CDS and stock markets. The implications of declining housing prices for publicly traded shares of financial institutions depended in large part on the effect of declining prices on the value of AAA CDO tranches. For a variety of reasons—ranging from inherent complexity and idiosyncratic terms to a misplaced trust in rating agencies and the absence of secondary trading—prices in the senior CDO "market" were

uniquely inefficient, just as the ECMH would have led us to expect them to be. Only prices of RMBSs reacted with a modicum of efficiency to early signs of weakness in the housing market and, even here, they became informationally sensitive largely as the result of a market innovation: the introduction of trading in the ABX.HE indices, which revealed new information by greatly improving the efficiency of hedging and arbitrage in the RMBS market. The market, in turn, became pessimistic in early 2007 and began to panic soon thereafter. The early tremors in the RMBS market collateralized by subprime and alt-prime mortgages eventually triggered tidal waves in the primary markets for CDOs and in the secondary stock market for large financial institutions, but only during the last quarter of 2007.

In our view, this chain of developments vindicates a modest form of the ECMH that incorporates market frictions and focuses principally on informational efficiency. It can be read to "refute" only an overblown framing of market efficiency, which makes the claim that market prices are fundamentally efficient in the sense of more or less accurately reflecting the discounted present value of the cash flows associated with market securities. This quasi-empirical (and thoroughly immodest) claim was the intellectual basis for advancing a broad agenda of deregulation in the capital markets. But it never quite made sense, not merely because it could not be tested directly, but more importantly because it failed to acknowledge the range of market frictions that impede informational efficiency, which is itself a necessary condition for any degree of fundamental efficiency in market prices. Unfortunately, however, misframing the ECMH as a strong and direct claim about the fundamental efficiency of market prices without regard to market frictions or informational efficiency has presented an easy target for the critics of market efficiency. This criticism, which builds upon the Subprime Crisis and other recent market shocks, threatens to remove all analysis of the efficiency of market prices from the regulatory agenda. Our concern is that the limited but genuinely helpful insights of a more modest ECMH will be lost in the general condemnation of animal spirits and noise traders.

A properly framed ECMH focuses our attention on the frictions that drive a wedge between relative efficiency and efficiency under perfect market conditions. So framed, relative efficiency is a diagnostic tool that identifies the frictions and information costs that reduce price efficiency. Relative efficiency thus provides part of a regulatory strategy to address the problems raised by the Crisis. It will not prevent future bubbles and

crises, but improving the performance of the mechanisms of market efficiency will make prices more efficient, frictions more transparent, and public sector agency costs more observable, which may in turn allow us to catch the next problem earlier. This would be no small accomplishment. Recall that as late as September 8, 2008, the Congressional Budget Office was still uncertain whether a "period of slow growth [resulting from the housing bubble] will ultimately be designated a recession," and was predicting 1.1% growth in 2009.[165] Eight days later, Lehman Brothers had failed and AIG was being nationalized. While perfect markets would be even better, a strategy of improving the relative informational efficiency of the markets is itself a substantial improvement in a friction-filled world and a prerequisite for fundamentally rational market prices.

[165] Cong. Budget Office, The Budget and Economic Outlook: An Update 23 (2008), available at http://www.cbo.gov/publication/41729.

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