

Complexity as a Catalyst of Market Failure: A Law and Engineering Inquiry¹

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Abstract: This article examines how the complexities of modern investment securities and the assets underlying them can trigger a breakdown of financial markets and also analyzes what should be done to mitigate the potential for market failure. Because these complexities are characteristic of complexities in nonlinear engineering systems, the article's analysis draws on the literature analyzing these systems.

I. REVIEWING THE ROLE OF COMPLEXITY IN THE SUBPRIME MORTGAGE CRISIS	5
II. COMPLEXITIES OF THE ASSETS UNDERLYING INVESTMENT SECURITIES, AND OF THE MEANS OF ORIGINATING THOSE ASSETS	8
III. COMPLEXITIES OF MODERN INVESTMENT SECURITIES	11
A. Complexities of Securities Can Impair Disclosure	11
B. Complexities of Securities Can Obfuscate Consequences	14
C. Complexities of Securities Can Make Financial Markets More Susceptible to Financial Contagion	16
D. Complexities of Securities Can Make Financial Markets More Susceptible to Fraud	18
IV. COMPLEXITIES OF MODERN FINANCIAL MARKETS	22
V. ADDRESSING MARKET FAILURES RESULTING FROM COMPLEXITY	28
<i>Addressing Information Failures Arising from Uncertainty</i>	29

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<i>Addressing Failures Arising from Nonlinear Feedback and Tight Coupling</i>	36
<i>Addressing Failures Arising from Misalignment</i>	40
<i>Should Regulation be Rules-based or Principles-based?</i>	46
VI. CONCLUSIONS	48

In a separate article, I examined financial-market anomalies and obvious market protections that failed, seeking insight into the subprime mortgage crisis.³ The crisis, I argued, can be attributed in large part to three causes: conflicts, complacency, and complexity.⁴ This article focuses on the third cause, complexity, initially reviewing its involvement in the subprime mortgage crisis and then applying lessons learned from complexity in engineering to go beyond that crisis to more generally examine the effect of complexity on financial markets and investments.

Complexity “didn’t arise for complexity’s sake, nor from a desire to obfuscate.”⁵ Rather, it arose for two reasons: first, in response to “demand by investors for securities that meet their investment criteria and their appetite for ever higher yields,”⁶ and second, in order to facilitate the transfer and trading of risk to those who prefer to hold it, promoting efficiency.⁷ For example, more complex securities can offer investors the opportunity to gain exposure to new asset types and markets—such as foreign currency, commodities, or residential mortgages—in turn enabling them to earn higher returns and more precisely hedge risk.⁸ Complex securities issued by special-purpose vehicles and

³ Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. (forthcoming in issue no. 2, 2008-09).

⁴ Running throughout these causes is a fourth cause, cupidity; but because greed is so ingrained in human nature and so intertwined with the other causes, it adds little insight to view it separately.

⁵ Peter Green & Jeremy Jennings-Mares, Letter to the Editor, FIN. TIMES, July 4, 2008, at 14.

⁶ *Id.*

⁷ Jennifer Bethel & Allan Ferrel, *Policy Issues Raised by Structured Products*, BROOKINGS-NOMURA PAPERS ON FIN. SERVS. 7 (2007) (explaining that structured products can promote efficiency in this way) (forthcoming). *See also* Steven L. Schwarcz, *The Alchemy of Asset Securitization*, 1 STAN. J.L. BUS. & FIN. 133, 134 (1994) (explaining that by separating a corporation’s liquid assets from its risks, it may obtain lower cost financing than if it were to directly issue debt or equity).

⁸ Bethel & Ferrel, *supra* note 7, at 7.

backed by pools of financial assets⁹ also enable firms to raise low-cost financing by accessing the ultimate source of funds, the capital markets, without going through banks or other financial intermediaries.¹⁰ Complexity thus can add efficiency and depth to financial markets and investments.

Nonetheless, complexity also can impair markets and investments in at least three interrelated ways. First, as the subprime crisis illustrated, the complexities of the assets underlying investment securities, and of the means of originating those assets, can lead to a failure of lending standards. Complexity in this sense derives from the complicated nature of these assets and their means of origination.¹¹ Second, the complexities of the investment securities themselves can lead to a failure of investing standards and financial-market practices. Complexity in this sense derives not only from complication but also from the difficulty of valuation. Senior securities, for instance, can carry higher credit ratings, and can be valued above, the ratings and value of their underlying assets.¹² Securities that pool together multiple classes of assets might also comprise a “complex

⁹ The term “financial assets” includes any type of asset, such as accounts receivable, rental payments, franchise payments, loans, or other rights to payment, that over a finite period of time converts into cash. Edward M. Iacobucci & Ralph A. Winter, *Asset Securitization and Asymmetric Information*, 34 J. LEGAL STUD. 161, 162 (2005). Cf. S.E.C. Rule 3a-7 (17 C.F.R. § 270.3a-7) (related definition of “Eligible Asset”).

¹⁰ Steven L. Schwarcz, *Enron and the Use and Abuse of Special Purpose Entities in Corporate Structures*, 70 U. CIN. L. REV. 1309, 1315 (2002). Capital markets are now the nation’s and the world’s most important sources of investment financing. *See, e.g.*, McKinsey Global Institute, *Mapping the Global Capital Markets Third Annual Report* (Jan. 2007), reporting that as of the end of 2005, the value of total global financial assets, including equities, government and corporate debt securities, and bank deposits, was \$140 trillion, available at http://www.mckinsey.com/mgi/publications/third_annual_report/index.asp.

¹¹ Cf. Merriam-Webster Online, *Complex*, <http://www.merriam-webster.com/dictionary/complex> (last visited June 5, 2008); Merriam-Webster Online, *Complicated*, <http://www.merriam-webster.com/dictionary/complicated> (last visited June 5, 2008) (defining “complicated” as “consisting of parts intricately combined” or “difficult to analyze, understand, or explain”).

¹² *See infra* note 29.

system” in which price volatility and liquidity is a function of patterns arising from the behavior of many independent, interactive, and constantly adaptive parties.¹³

Finally, complexity exacerbates and amplifies failures in markets and investments due to nonlinear positive feedback effects. These effects arise from “tight coupling” within credit markets—a condition in which events tend to move rapidly into a crisis mode with little time or opportunity to intervene¹⁴—and are most pronounced when markets are illiquid and market participants are highly leveraged. Here, complexity indicates that financial markets are, by reason of the interactive behavior of independent market participants, complex systems subject to nonlinearity and volatility.¹⁵

In the face of these types of market failures, one must ask what steps should be taken by market participants to eliminate or alleviate the failures and what regulatory approaches are necessary or desirable to ensure that market participants take these steps. To this end, Part I of this article reviews how complexity contributed to the subprime mortgage crisis. The article then examines the three interrelated ways in which complexity can impair markets and investments: Part II focuses on how the complexities of the assets underlying modern investment securities and the means of originating those assets can lead to a failure of lending standards; Part III focuses on how the complexities of the investment securities can lead to a failure of investing standards and financial-market practices; and Part IV focuses on how the complexities of modern financial markets can exacerbate these market failures. Because these complexities are characteristic of complexities in nonlinear engineering systems, the article’s analysis

¹³ See W. Brian Arthur, *Complexity and the Economy*, SCIENCE, Apr. 2, 1999, at 107 (defining economic complexity as the tendency for patterns to emerge from systems, organizations, or products with many interdependent parts or actors that would not be predicted from classical linear economic models).

¹⁴ I thank Rick Bookstaber for introducing this term, originally borrowed from engineering nomenclature, to financial markets. See BOOKSTABER, *infra* note 69, at 144

¹⁵ See Arthur, *supra* note 13 (observing that complex systems can cause volatility).

draws in part on the literature analyzing these systems.¹⁶ Finally, Part V of the article uses an engineering framework to examine what should be done to address the failures, focusing on what market participants should be doing and reviewing what regulatory approaches may be needed.

I. REVIEWING THE ROLE OF COMPLEXITY IN THE SUBPRIME MORTGAGE CRISIS

Complexity contributed to the subprime mortgage crisis in several ways. Primary culpability was said to derive from the “originate-and-distribute” model of mortgage lending,¹⁷ under which mortgage lenders would sell off loans as they were made.¹⁸ Third parties—including government sponsored entities such as Freddie Mac and Fannie Mae, government agencies such as Ginnie Mae, and private investment banks—would then purchase the loans and package them into mortgage-backed securities.¹⁹ This “securitization” process increased the accessibility and affordability of mortgage lending by indirectly funding such lending through the capital markets.²⁰ Nonetheless, because the interests of the lenders were no longer aligned with the interests of the owners of the loans (the investors in the mortgage-backed securities effectively becoming owners of the

¹⁶ This article is not the first to draw an analogy between financial markets and nonlinear engineering systems. Cf. David A. Hsieh, *Chaos and Nonlinear Dynamics: Application to Financial Markets*, 46 J. FIN. 1839 (1991) (drawing a similar analogy).

¹⁷ This model is also referred to as “originate to distribute.”

¹⁸ Unlike lending practices common several decades ago, today mortgages are most often sold to third parties shortly after being written: thus, originated and then distributed. Richard J. Rosen, *The Role of Securitization in Mortgage Lending*, Federal Reserve Bank of Chicago, Nov. 2007.

¹⁹ *Id.*

²⁰ *Id.* The capital markets are “markets where capital funds—debt and equity—are traded. Included are private placement sources of debt and equity as well as organized markets and exchanges.” JOHN DOWNES & JORDAN GOODMAN, *DICTIONARY OF FINANCE AND INVESTMENT TERMS* 59 (3d ed. 1991).

loans²¹), there is concern that the originate-and-distribute model fostered moral hazard on the part of the lenders,²² resulting in lax lending standards.²³

Because the originate-and-distribute model continues to be fundamental to a wide range of lending and other credit extension²⁴ and is critical to the funding liquidity of banks²⁵ and corporations,²⁶ the importance of this model goes beyond mortgage loans, mortgage-backed securities, and the subprime mortgage crisis.

The complexities of the securities associated with the subprime mortgage crisis also contributed to that crisis by impairing disclosure, obfuscating the ability of market participants to see and judge consequences, and making financial markets more

²¹ These securities are discussed *infra* notes 23-33 and accompanying text.

²² Moral hazard means, in this context, the greater tendency of people who are protected from the consequences of risky behavior to engage in such behavior. *See, e.g.*, Charles G. Hallinan, *The “Fresh Start” Policy in Consumer Bankruptcy: A Historical Inventory and an Interpretive Theory*, 21 U. RICH. L. REV. 49, 84 (1986).

²³ David Henry & Matthew Goldstein, *The Bear Flu: How it Spread*, BUS. WK., Jan. 7, 2008, at 30 (arguing that the distance between mortgage-loan originators and the ultimate holders of the loans encouraged lax lending); Martin Feldstein, Op-Ed, *How to Stop the Mortgage Crisis*, WALL ST. J., Mar. 7, 2008, at A15 (describing lax lending standards that gave rise to mortgages with loan-to-value ratios of nearly 100%, and citing the 1.8 million mortgages then in default). *Cf.* John C. Dugan, Comptroller of Currency, Speech given at The Annual Convention of The American Bankers Association, San Diego, Oct. 8, 2007, at 5, <http://www.occ.treas.gov/ftp/release/2007-109a.pdf> (last visited July 16, 2008) (observing that with the increasing use of the originate-and-distribute model of lending, lending standards shifted from evaluating the likelihood of repayment to evaluating the likelihood that the loan could be sold). [update data-cite]

²⁴ [cite]

²⁵ *See, e.g.*, Joseph R. Mason, “Mortgage Loan Modification: Promises and Pitfalls” (undated Powerpoint presentation to the Federal Reserve Bank of Cleveland at its workshop on “Structured Finance and Loan Modification,” Nov. 20, 2007) (showing that 58% of mortgage liquidity in the United States, and 75% of mortgage liquidity in California, has come from structured finance, which relies on the originate-and-distribute model).

²⁶ *See* Xudong An, Yongheng Deng & Stuart A. Gabriel, *Value Creation Through Securitization: Evidence from the CMBS Market* 3 (Feb. 18, 2008) (SSRN working paper no. 1095645) (concluding that despite the recent mortgage crisis, securitizing financial assets through the originate-and-distribute model has created value in the financial markets).

susceptible to financial contagion and to fraud.²⁷ Mortgage-backed securities, for example, were typically issued through special-purpose vehicles (“SPVs,” sometimes called special-purpose entities, or “SPEs”), and payment on such securities derived principally or entirely from the mortgage loans owned by the SPVs. In many cases, the securities were even more complex. CDO, or “collateralized debt obligation,” securities were backed by—and thus their payment derived principally or entirely from—a mixed pool of mortgage loans and other financial assets owned by SPVs.²⁸ ABS CDO securities were backed by a mixed pool of mortgage- and other asset-backed securities.²⁹

Because huge segments of modern finance in the United States and abroad continue to operate in similar ways, involving the complex issuance by SPVs of securities backed by a wide range of financial assets (such securities being called “asset-backed securities,” and the process of creating and issuing asset-backed securities being called “securitization”³⁰),³¹ the potential of these complexities to impair disclosure, to obfuscate

²⁷ There are even more arcane variations on these securities, such as CDOs “squared” or “cubed,” but they go beyond this article’s analysis.

²⁸ Securities backed by assets *other than mortgage loans* are sometimes referred to in the securitization industry as asset-backed securities or ABS. This article will use the term asset-backed securities to generically mean securities backed by any types of assets, including mortgage loans.

²⁹ The classes, or “tranches,” of securities issued in securitization transactions are typically ranked by seniority of payment priority. The highest priority classes are called senior securities. Lower priority classes are usually called mezzanine securities—with the lowest priority class, which has a residual claim against the SPV, being called the equity. The senior and many of the subordinated classes of these securities are more highly rated than the quality of the underlying mortgage loans. For example, senior securities issued in a CDO transaction are usually rated AAA even if the underlying income-generating assets consist of subprime mortgages, and senior securities issued in an ABS CDO transaction are usually rated AAA even if none of the underlying securities supporting the transaction are rated that high. This is accomplished by allocating cash collections first to pay the senior classes and thereafter to pay more junior classes. In this way, the senior classes are highly overcollateralized to take into account the possibility, indeed likelihood, of delays and losses on collection.

³⁰ Securitization generally means the process of turning financial assets into securities issued by an SPV. Schwarcz, *The Alchemy of Asset Securitization*, *supra* note 7, at 135.

³¹ STEVEN L. SCHWARCZ, *STRUCTURED FINANCE, A GUIDE TO THE PRINCIPLES OF ASSET SECURITIZATION* §[cite] (3d ed. & supps. 2006) (hereinafter, “STRUCTURED FINANCE”)

the ability of market participants to see and judge consequences, and to make financial markets more susceptible to financial contagion and fraud goes beyond mortgage-backed securities and the subprime mortgage crisis.

This article next examines all these complexities in a broader financial-market context.

II. COMPLEXITIES OF THE ASSETS UNDERLYING INVESTMENT SECURITIES, AND OF THE MEANS OF ORIGINATING THOSE ASSETS

The complexities of the assets underlying investment securities, and of the means of originating those assets, can lead to a failure of lending standards. Consider first the complexities of the underlying assets. These include, besides mortgage loans, a wide range of other financial assets.³² Each type of underlying asset requires a separate approach to modeling and valuation, including estimation of default risk, interest rate risk, and prepayment risk (the risk that the borrower might prepay the loan balance at any time, thereby jeopardizing the asset's anticipated return on investment).³³ To further complicate matters, prepayment risk is correlated with interest rate risk: when rates fall, borrowers are more likely to prepay; whereas when rates rise, borrowers are more likely

(discussing securitization as a dominant means of financing in the United States and abroad).

³² Iacobucci & Winter, *supra* note 9, at 162.

³³ THOMAS S. Y. HO & SANG BIN LEE, *THE OXFORD GUIDE TO FINANCIAL MODELING: APPLICATIONS FOR CAPITAL MARKETS, CORPORATE FINANCE, RISK MANAGEMENT, AND FINANCIAL INSTITUTIONS* 348 (2004). Some assets, such as credit card loans, are further complicated because, unlike mortgage loans, they have no fixed payment amount or amortization schedule. Borrowers may pay in full, pay a minimum payment (usually 2% of the outstanding balance), or even increase their balance up to a specified credit limit. Mark Furletti, *An Overview of Credit Card Backed Securities 2* (Dec. 2002 unpublished manuscript) (on file with author); Susan Baig, *CDO of ABS: A Primer on Performance Metrics and Test Measures*, YieldCurve.com at 4 (last visited June 12, 2008). To address these challenges, credit card securities are typically issued separately through a revolving master trust, within which several credit accounts are pooled together to allow for multiple bond issues as well as a revolving flow of receivables. *Id.*

to default.³⁴ These risks are also dynamic in that they fluctuate over time, and mathematical models that attempt to estimate the dynamic correlation are, at best, approximations.³⁵ Furthermore, as models become more sophisticated to take into account interest rate movements, they rely on an increasing number of assumptions and historical data which, if incorrect, will make the valuations incorrect.³⁶ When multiple asset classes underlie a given class of securities, valuation can become exponentially complicated.

In addition to complex modeling and valuation, the terms and conditions of financial assets can also be complex. In the subprime crisis, for example, loan originators made mortgage-loan products more varied and sophisticated, and offered these products to a wider range of borrowers, or mortgagors, purportedly in order to meet market demand.³⁷ These products included terms such as adjustable rates, low-to-zero down payment requirements, interest-only payment options, and negative amortization.³⁸ Because of this complexity, some borrowers did not fully understand the risks they were incurring³⁹ and, as a result, defaulted at a much higher rate than would be predicted by

³⁴ MARK ADELSON, MBS BASICS (Nomura Sec. Int'l 2006) (describing the property of negative convexity in mortgage-backed securities).

³⁵ Thomas S. Y. Ho & Sang Bin Lee, *The Oxford Guide to Financial Modeling: Applications for Capital Markets, Corporate Finance, Risk Management, and Financial Institutions* 29 (2004) (discussing Monte Carlo simulations, which condition prepayment risk upon hypothetical interest rate fluctuations); *Advanced Analytics v. Citigroup*, 2008 WL 2557421, 1 (describing as “complex” the computerized process used to estimate prepayment risk).

³⁶ ADELSON, *supra* note 34.

³⁷ Edward Vincent Murphy, *Alternative Mortgages: Risks to Consumers and Lenders in the Current Housing Cycle*, CRS Report RL33775 at 5-6 (Dec. 27, 2006), http://assets.opencrs.com/rpts/RL33775_20061227.pdf (last visited July 21, 2008).

³⁸ *Id.* at 12.

³⁹ Patricia A. McCoy & Elizabeth Renuart, *The Legal Infrastructure of Subprime and Nontraditional Home Mortgages* 19, Joint Center for Housing Studies, Harvard University, Feb. 2008, http://www.jchs.harvard.edu/publications/finance/understanding_consumer_credit/papers/ucc08-5_mccoy_renuart.pdf (last visited July 21, 2008).

the historical mortgage-loan default rates relied on by loan originators in extending credit.⁴⁰

The complexities of the means of originating these assets also can lead to a failure of lending standards. As discussed, the originate-and-distribute model of mortgage lending is believed to have contributed to the subprime crisis by fostering moral hazard.⁴¹ An important question here is why the ultimate owners of the loans—the distributees, which in the subprime crisis were the parties buying the mortgage-backed securities⁴²—did not impose on the originator the same strict lending standards that they would otherwise observe but for the separation of origination and ownership?

There appear to be several answers, with ramifications beyond the subprime crisis. First, by separating the ultimate owners of the mortgage loans from the actual lenders, an originate-and-distribute model makes it difficult for those owners to always see the big picture.⁴³ Like the fable of a blind person describing an elephant by touching only a part,⁴⁴ owners often focused on isolated aspects of the market. Separating the

⁴⁰ Edward Golding, Richard K. Green, & Douglas A. McManus, *Imperfect Information and the Housing Finance Crisis* 16, Joint Center for Housing Studies, Harvard University, Feb. 2008, http://www.jchs.harvard.edu/publications/finance/understanding_consumer_credit/papers/ucc08-6_golding_green_mcmanus.pdf (last visited July 21, 2008); Kurt Eggert, Subprime Mortgage Market Turmoil: Examining the Role of Securitization, Testimony before Senate Subcommittee on Securities, Investments and Insurance, April 17, 2007, at 4, http://banking.senate.gov/public_files/eggert.pdf (last visited July 21, 2008).

⁴¹ See *supra* notes 18-23 and accompanying text.

⁴² See, e.g., Richard J. Rosen, *The Role of Securitization in Mortgage Lending*, Federal Reserve Bank of Chicago, Nov. 2007 (describing the process of mortgage securitization as the sale of loans to an investor who might hold them or repackage loans into securities—which may in turn be sold or again repackaged—such that the ultimate mortgage owner is several steps removed from the borrower).

⁴³ See, e.g., Telephone Interview with Alan Hirsch, Director, North Carolina Policy Office (Feb. 20, 2008) (observing that the originate-and-distribute model made the structure “so complex that no one followed the trail”); Dugan Speech, *supra* note 23 (arguing that investors were unable to fully understand the complicated securities they bought).

⁴⁴ Godfrey Saxe, *The Blindmen and the Elephant*, Poem (based on a South Asian parable).

ultimate owners also can create a collective-action problem when those owners are widely dispersed.⁴⁵ This occurred in the subprime crisis through the securitization of subprime mortgage loans, making it difficult for owners to agree on underlying lending standards as well as making it difficult to agree on loan monitoring, or “servicing,” standards.⁴⁶ Furthermore, to the extent an originate-and-distribute model reduces the size of any given owner’s investment below an amount sufficient to motivate the owner to engage in due diligence and monitoring, it could induce undue reliance on rating-agency ratings.⁴⁷

The foregoing discussion focuses on how the complexities of the assets underlying modern securities and the means of originating those assets can impair financial markets. As the next discussion shows, the complexities of the securities backed by these assets also contributes to the breakdown of financial markets.

III. COMPLEXITIES OF MODERN INVESTMENT SECURITIES

The complexities of modern investment securities can lead to a failure of investing standards and financial-market practices for at least four reasons: these complexities impair disclosure; they obfuscate the ability of market participants to see and judge consequences; and they make financial markets more susceptible to financial contagion and also more susceptible to fraud.⁴⁸ This part explains why these complexities can lead to failure.

A. Complexities of Securities Can Impair Disclosure

⁴⁵ Schwarcz, *Protecting Financial Markets*, *supra* note 3, at ___.

⁴⁶ *Id.* See also Martin Feldstein, Op-Ed, *How to Stop the Mortgage Crisis*, WALL ST. J., Mar. 7, 2008, at A15 (explaining that the separation of borrowers from the ultimate owners of mortgages frustrated the ability to effectively service or renegotiate troubled loans).

⁴⁷ See *infra* note XX and accompanying text.

Complexity can deprive investors and other market participants of the knowledge needed for markets to operate effectively.⁴⁹ Even if all information about a complex structure is disclosed,⁵⁰ complexity increases the amount of information that must be analyzed in order to value the investment. This additional analysis entails higher cost.⁵¹ According to rational ignorance theory, there is a point at which the benefit obtained from additional analysis can be outweighed, or at least appear to be outweighed, by the costs of performing that analysis.⁵² In the context of securities markets, this means that firms deciding whether to allocate more analyst time or hire additional experts to analyze possible investments might view the added tangible costs as outweighing the uncertain gain.⁵³

For example, except for anticipating quite how profoundly home prices would drop, virtually all of the risks giving rise to the collapse of the market for securities backed by subprime mortgages appear to have been disclosed.⁵⁴ Investors did not,

⁴⁸ See *supra* note 27 and accompanying text.

⁴⁹ See generally Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILL. L. REV. 1.

⁵⁰ Cf. Malcolm Gladwell, *Open Secrets: Enron, Intelligence, and the Perils of Too Much Information*, NEW YORKER, Jan. 8, 2007 (distinguishing between transactions that are merely “puzzles” and those that are truly “mysteries”). To the extent complexity is merely a puzzle, investment bankers theoretically could understand it.

⁵¹ Anuj K. Shah & Daniel M. Oppenheimer, *Heuristics Made Easy: An Effort-Reduction Framework*, PSYCHOL. BULL., Mar., 2006, at 207 (describing costs of information analysis as identification of relevant data, storing of that data, assessing the weight of each piece of data, integrating alternative sources of data, and parsing or analyzing the data to produce actionable information).

⁵² Community Leader’s Letter, The Theory of Rational Ignorance, Community Leader’s Letter: Econ. Brief N. 29 (available at: <http://www.strom.clemson.edu/teams/ced/econ/8-3No29.pdf>); Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 49, at ___ (explaining why institutional investors face declining incentives to hire experts to parse information relating to structured products as those products increase in complexity).

⁵³ Steven L. Schwarcz, *Disclosure’s Failure in the Subprime Crisis*, ___ UTAH L. REV. ___, ___ (2008).

⁵⁴ *But cf.* Mark Adelson & David Jacob, *ABS/MBS Litigation Outlook*, Adelson & Jacob Consulting, Nov. 19, 2007, available at: http://adelsonandjacob.com/pubs/Litigation_Outlook.pdf (arguing that “disclosure materials generally did not highlight the [aggressive marketing of] stated-income loans to W-2 wage earners [T]he changing character of the stated-income loans (i.e., more

however, appreciate these risks, in large part because the complexity of these securities made the risks almost impossible to understand.⁵⁵ The prospectus itself in a typical offering of these securities can be hundreds of pages long.⁵⁶ Searching through this vast volume of “information” is to some extent akin to the difficulty that would be posed by searching the Internet without a search engine, such as Google, to systematically filter through and organize results.

Investment analysts thus often resort to simplifying heuristics, such as credit ratings, as substitutes for attempting to fully understand the investments being analyzed.⁵⁷ In the subprime crisis, for example,

A lot of institutional investors bought securities substantially based on their ratings [without fully understanding what they bought], in part because the market has become so complex.⁵⁸

wage earners) generally was not [disclosed]. . . . Issuers routinely disclosed that they allowed exceptions to their subprime mortgage underwriting criteria. However, they did not generally indicate whether the prevalence of these exceptions was increasing during the relevant period.”).

⁵⁵ COUNTERPARTY RISK MANAGEMENT POLICY GROUP III, CONTAINING SYSTEMIC RISK: THE ROAD TO REFORM 53 (Aug. 6, 2008) (hereinafter “CRMPG III REPORT”) (observing “there is almost universal agreement that, even with optimal disclosure in the underlying documentation, the characteristics of [several classes of securities] were not fully understood by many [large integrated financial intermediaries, hedge funds, specialized financial institutions, and other] market participants”).

⁵⁶ The disclosure documents ordinarily consist of a prospectus and a prospectus supplement, each close to two-hundred pages long.

⁵⁷ Cf. Shah & Oppenheimer, *supra* note 51, at 207 (explaining results of behavioral psychology experiment demonstrating that individuals increasingly employ heuristics to reduce the cost of analysis when time pressures or opportunity costs are high).

⁵⁸ *Credit & Blame: How Rating Firms’ Calls Fueled Subprime Mess*, WALL ST. J., Aug. 15, 2007, at A1 (quoting a market observer). See also Alan S. Blinder, *Six Fingers of Blame in the Mortgage Mess*, N.Y. TIMES, Sept. 30, 2007, at BU 4 (arguing that mortgage-backed securities, especially CDO securities, “were probably too complex for anyone’s good”); Aaron Lucchetti, Kara Scannell & Craig Karmin, *SEC Aims to Rein In the Role of Ratings*, WALL ST. J., June 24, 2008, at C1 (observing that “The dirty secret of some bond investors is that they simply bought securities with the highest yield for a

Although the use of heuristics might be efficient overall in certain applications, heuristic reasoning can sometimes expose analysis to bias and systematic error.⁵⁹ In the context of securities disclosure, exclusive reliance on ratings ignores the additional information that is essential to a truly competitive market in financial information.⁶⁰

B. Complexities of Securities Can Obfuscate Consequences

When securities are highly complex, parties reviewing, or even structuring, the securities may not always appreciate all the consequences.⁶¹ In the subprime mortgage crisis, for example, few saw that although ABS CDO transactions were backed by what appeared to be significantly diverse securities, there was an underlying correlation in the subprime mortgage loans backing many of those securities.⁶² Few, not even rating agencies, saw this correlation.⁶³ Although in retrospect one may say the correlation should have been realized, hidden correlations are only observable when there is full appreciation of the underlying variables.

For example, during the late 1970s and early 1980s, when oil prices had steadily increased, investors failed to recognize an underlying correlation with mobile home

given rating, which is why they snapped up complicated securities tied to subprime mortgages”).

⁵⁹ Christine Jolls, Cass R. Sunstein, & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1777 (1998); M. GRANGER MORGAN & MAX HENRION, UNCERTAINTY: A GUIDE TO DEALING WITH UNCERTAINTY IN QUANTITATIVE RISK AND POLICY ANALYSIS 47 (1990).

⁶⁰ Cf. Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 714 (2006) (arguing that a precise understanding of financial-market investments is essential to a truly competitive market).

⁶¹ A related concern arises to the extent securities become so highly complex that, as Professor Kenneth Klee has suggested, parties sometimes have difficulty understanding their documentation. Kenneth Klee, Remarks at the International Insolvency Institute’s Eighth Annual International Insolvency Conference (June 10, 2008; notes on file with author).

⁶² Schwarcz, *Protecting Financial Markets*, *supra* note 3, at ____.

⁶³ *Id.* at _____. Rating agencies make their business in carefully assessing the creditworthiness of investment securities. See generally Steven L. Schwarcz, *Private Ordering of Public Markets: The Rating Agency Paradox*, 2002 U. ILLINOIS L. REV. 1.

loans, which were a popular alternative for diversification. As it turned out, an oil boom in Oklahoma drew an influx of oil workers creating the fastest growing market for mobile home loans. When oil prices crashed, drilling in Oklahoma ceased, resulting in massive unemployment and causing widespread defaults on the mobile home loans.⁶⁴ Because of hidden correlations, risk assessments frequently fail to take into account all variables.⁶⁵

The loan servicing problem, discussed earlier,⁶⁶ likewise results from the complexity of securities obfuscating consequences. Parties did not anticipate that the separate allocation of cash flows deriving from principal and interest to different investor tranches of mortgage-backed securities would lead, in a default scenario, to conflicts among investors, which in turn would make servicers reluctant to exercise the discretionary judgment needed to restructure the underlying mortgage loans—since exercising any discretion might expose servicers to liability.⁶⁷

The complexities of securities also can obfuscate consequences when payoffs on the securities are linked to unrelated events. Due to nonlinearity found in complex systems, small events can cause seemingly unrelated catastrophes as when a simple clogged pressure-release valve escalated into a meltdown at the Three-Mile Island nuclear reactor.⁶⁸ Similarly in financial markets, consequences can be obfuscated when, for example, options or other derivative instruments have payoffs that are not linearly related to the prices of their underlying securities, so that information on day-to-day market movements cannot be used to predict the payoff if the market moves dramatically.⁶⁹

⁶⁴ Paul Bennett, *Effective Monetary Policy in the U.S. and Emerging Markets*, Istanbul Bilgi University, Sept. 6-8, 2006 (unpublished manuscript on file with author) (discussing that “variables” that remains unchanged for long periods can obscure correlation).

⁶⁵ *Id.*

⁶⁶ *See supra* notes 216-219 and accompany text.

⁶⁷ *See supra* note 219 and accompanying text (discussing “tranche warfare”).

⁶⁸ Richard Bookstaber, *The Myth of Non Correlation*, INSTITUTIONAL INVESTOR, Sept. 2007, at 82.

C. Complexities of Securities Can Make Financial Markets More Susceptible to Financial Contagion

The complexities of securities can make financial markets more susceptible to financial contagion. In the subprime crisis, the complexities of securities made it easier for problems with subprime mortgage-backed securities to quickly infect the securitization and other credit markets generally. Investors did not always understand how CDO and ABS CDO securities worked, and therefore were prone to rely, in their investment decisions, on the fact that tranches of those securities were rated “investment grade” by such top rating agencies as Standard & Poor’s, Moody’s, and Fitch.⁷⁰ When those investment-grade tranches later lost money,⁷¹ the resulting uncertainty caused investors to panic, fearing that other highly-rated securities could likewise default.⁷²

The complexities of securities also can make market infections more contagious. For example, in the subprime crisis many mortgage-backed securities were guaranteed as to payment by “monoline” insurers, or specialized financial insurance companies that

⁶⁹ RICHARD BOOKSTABER, *A DEMON OF OUR OWN DESIGN: MARKETS, HEDGE FUNDS, AND THE PERILS OF FINANCIAL INNOVATION* 156 (2007).

⁷⁰ Investment grade technically means a rating of BBB- or better. Schwarcz, *supra* note 63, at 7. An investment-grade rating indicates that full and timely repayment on the securities should not be speculative. *See id.* at 7-8.

⁷¹ *See, e.g.*, Carrick Mollenkamp & Serena Ng, *Wall Street Wizardry Amplified Credit Crisis*, WALL. ST. J., Dec. 27, 2007, at A1 (reporting on the downgrade of one CDO’s triple-A rated tranches to junk status).

⁷² *See, e.g.*, Mortimer B. Zuckerman, *Preventing a Panic*, U.S. NEWS & WORLD REP., Feb. 11, 2008, at 63-64 (arguing that “the credit system has been virtually frozen” because “few people even know where the liabilities and losses are concentrated”). In economic terms, this can be seen as a variant on adverse selection. *Cf.* Edward L. Glaeser & Hedi D. Kallal, *Thin Markets, Asymmetric Information, and Mortgage-Backed Securities*, J. FIN. INTERMEDIATION, Jan., 1997, at 64 (describing a common adverse selection problem within mortgage-backed securities: that issuers of mortgage-backed securities have greater familiarity with the product and special information regarding its quality); George A. Akerlof, *The Market for “Lemons”: Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488, 488 (1970) (describing the agency costs that arise in the common situation where sellers have better information regarding the quality of a good than the buyers; and discussing that when buyers use some statistic or rating to

guarantee principal and interest payments to investors on certain structured-finance and municipal securities. Monoline insurers traditionally have been thinly capitalized, the justification being that they use statistical models to stress-test every potential scenario and insure only securities that pass these tests.⁷³ In the subprime mortgage crisis, however, monolines did not always adequately stress-test for the scenario of rapidly falling house prices, as a result of which they had to make payments on defaulting securities far exceeding their projections. This caused some monolines to lose their rating-agency required capital cushions and, thus, their AAA ratings, which in turn caused many monoline-guaranteed securities to lose their ratings.⁷⁴ Because of uncertainty as to which securities were guaranteed by monolines and the inherent complexity of the monoline statistical rating scheme, some investors avoided any types of securities that were customarily guaranteed by monolines, even those with fundamental underlying strength.⁷⁵

This is well exemplified by the resulting crisis in the auction-rate-note (“ARNs”) market. ARNs are long-term debt securities with short-term resetting interest rates issued by municipalities, museums, schools, and similar entities.⁷⁶ Many ARNs are guaranteed by monoline insurers.⁷⁷ In February 2008, however, investors were able to find few buyers for their notes because potential buyers feared that the monolines, which also were

judge quality, overall quality for goods might decline as the benefits of quality accrue to the statistical group rather than an individual seller).

⁷³ *A Monoline Breakdown?*, ECONOMIST, Jul 28, 2007, at 79.

⁷⁴ David Enrich & Peter Eaivs, *More Subprime Pain in Store—UBS Write-Downs, Insurer Downgrades Point to More Unraveling*, WALL ST. J., Jan. 31, 2008, at __.

⁷⁵ Aline Van Duyn & Gillian Tett, *Markets Assess the Costs of a Monoline Meltdown*, FIN. TIMES, February 20, 2008, <http://www.ft.com/cms/s/0/8d715b9e-dfe9-11dc-8073-0000779fd2ac.html> (last visited July 16, 2008).

⁷⁶ Liz Rappaport & Kara Scannell, *Credit Crunch: Auction-Rate Turmoil Draws Watchdogs’ Scrutiny*, WALL ST. J., at C2 (Feb. 22, 2008).

⁷⁷ Eric R. Sirri, Testimony: The State of the Bond Insurance Industry (Before the Subcommittee on Capital Markets, Insurance, and Government Sponsored Enterprises, Committee on Financial Services, U.S. House of Representatives), Feb. 14, 2008, <http://www.sec.gov/news/testimony/2008/ts021408ers.htm> (last visited July 16, 2008).

insuring large amounts of securities backed by subprime mortgages, would default. Buyers started avoiding all ARNs, even those of strong issuers.⁷⁸

The complexities of securities also can contribute to infection insofar as securities are so specialized and sophisticated that they have no actual or active trading market. Absent market valuation, these securities are typically valued by using highly complex mathematical models, a valuation procedure sometimes called “marking to model.”⁷⁹ Like all mathematical models, the models for valuing securities are based on assumptions.⁸⁰ If these assumptions turn out to be wrong, it could trigger a panic among all investors in those securities. This occurred, for example, in the subprime crisis where the assumptions underlying mark-to-model valuation of CDO and ABS CDO securities turned out to be wrong, triggering panic among investors who did not (and, in the absence of a trading market or a reliable model, could not) know what those securities were worth.⁸¹

D. Complexities of Securities Can Make Financial Markets More Susceptible to Fraud

Complexity also can facilitate fraud, especially in the case of complex asset-backed securities transactions.⁸² To understand why, compare asset-backed securities

⁷⁸ See, e.g., THE BOND BUYER, Feb. 21, 2008, at 4 (observing that failed auctions are “occurring in spite of the fact that the underlying credit quality of issuers remains strong”).

⁷⁹ Neil Shah, *Can Wall Street be Trusted to Value Risky CDOs?*, REUTERS, July 13, 2007, available at <http://www.reuters.com/article/reutersEdge/idUSN0929430320070713>.

⁸⁰ *Id.* (detailing comments by M.I.T. Finance Professor Andrew Lo explaining that models used to value illiquid assets can “[break] down rather dramatically during abnormal times” because the assumptions underlying the models fail).

⁸¹ See, e.g., Floyd Norris, *Reading Write-Down Tea Leaves*, N.Y. TIMES, Nov. 9, 2007, at C1 (discussing the problems related to using valuation models). See generally Ingo Fender & John Kiff, *CDO rating methodology: Some thoughts on model risk and its implications*, Bank of International Settlements, Working Paper 163, Nov. 2004, available at <http://www.bis.org/publ/work163.htm> (last visited March 6, 2007) (discussing the problems associated with the valuation models used by rating agencies).

⁸² See *supra* note 28 and accompanying text (defining asset-backed securities).

with ordinary corporate debt securities, like bonds. When a company issues bonds, investors purchase the bonds based on the company's ability to repay, which turns on the company's public reputation for financial integrity and governance.⁸³ Although there certainly have been frauds, like Parmalat, WorldCom, and Global Crossing, where the reality belied the company's reputation,⁸⁴ reputation is built up slowly and thus hard to fake. For example, a corporation's reputation for financial integrity is derived from actual earnings as reported through financial statements and corroborated by independent certified public accountants.⁸⁵ With increased personal responsibility placed on corporate managers by the Sarbanes-Oxley Act, it is difficult, at least for public companies, to feign financial integrity.⁸⁶ A corporation's reputation for governance derives from the quality of management, which is tested and built up over time by individual managers.⁸⁷ When companies lack a good public reputation, they find it difficult if not impossible to issue bonds in the capital markets.⁸⁸

⁸³ Cf. Technical Committee of The International Organization Of Securities Commissions, *The Role of Credit Rating Agencies In Structured Finance Markets: Final Report*, at 4, May 2008, <http://www.iosco.org/library/pubdocs/pdf/IOSCOPD270.pdf> (last visited, August 8, 2008) (finding that credit rating agencies examine a firm's financial stability in determining the likelihood an issued security would be repaid); Hollis Ashbaugh-Skaife, Daniel W. Collins, & Ryan LaFond, *The Effects of Corporate Governance on Firms' Credit Ratings*, J. ACCT. & ECON. 42, 203-43 (2006) (finding that weak corporate governance results in poorer credit ratings).

⁸⁴ [What about Enron? That was a hybrid, being only partly a fraud and also involving asset-backed securities. Cite-SLS]

⁸⁵ Further, even the quality reputation of the auditing firm that verifies financial statements is widely believed to influence litigation exposure and the cost of raising capital. Inder K. Khurana & K. K. Raman, *Litigation Risk and the Financial Reporting Credibility of Big 4 Versus Non-Big 4 Audits: Evidence from Anglo-American Countries*, 79 ACCT. R. 473, 474 (2004).

⁸⁶ Among other things, the Sarbanes-Oxley Act of 2002 requires corporate officers and similar managers to certify the accuracy and completeness of each annual report, and to certify that internal controls are in place such that managers and auditors are apprised of material information relating to the issuer and its subsidiaries. 69 AM. JUR. 2d *Securities Regulation* § 454 (2008).

⁸⁷ David Hirshleifer, *Managerial Reputation and Corporate Investment Decisions*, 22 FIN. MGMT. 145, 146 (explaining that investor beliefs about manager and firm reputation influence the cost of raising capital, recruiting employees, and marketing products).

⁸⁸ See *supra* note 83 (because many investors are limited to only bonds that carry investment-grade ratings, a poor reputation that results in poor credit ratings will restrict a firm's access to capital).

The use of asset-backed securities, however, enables even companies without good public reputations to obtain capital-market financing indirectly by using their financial assets. Because asset-backed securities transactions are designed to withstand even a bankruptcy of the company, investors rely less on the company's reputation and much more on the ability of the financial assets to repay the securities.⁸⁹ Therefore, much is done to monitor those assets.⁹⁰

For example, under existing best-practice standards for monitoring,⁹¹ one or more of the underwriters, trustees (or similar agents acting on behalf of the investors), and servicers of the asset-backed securities (hereinafter referred to as the "due-diligence parties") will engage in the following due diligence procedures.⁹²

Before the asset-backed securities transaction is actually closed, the due-diligence parties typically review audited financial statements of the company certified as complying with generally accepted accounting standards. They also typically visit the company's offices to meet with management and to discuss applicable servicing practices, collections practices, and credit underwriting practices for the financial assets. The due-diligence parties then review data provided by the company examining, among

⁸⁹ STRUCTURED FINANCE, *supra* note 31, at §3:1.

⁹⁰ Query the extent to which the acceptability of this monitoring derived from traditional asset-backed (sometimes called asset-based) finance. To that extent, there may be a disconnect because traditional asset-backed finance dealt with collateral for loans, but the company was still important because if it went bankruptcy there would be an automatic stay and other bad consequences for the asset-backed lender. *See, e.g.,* Steven L. Schwarcz, *The Easy Case for the Priority of Secured Claims in Bankruptcy*, 47 DUKE L. J. 425, ___ (1997) (discussing how bankruptcy impacts secured creditors). These same monitoring techniques may have carried over into bankruptcy-remote asset-backed securities transactions, such as securitization.

⁹¹ [*Compare* standards for public offerings, where there is an underwriter due-diligence defense under the securities laws based on process. cite (*see* SLS for notes on SFC)]

⁹² Sometimes, the due-diligence parties themselves look to independent third-party industry experts to perform a portion of this diligence on their behalf. [cite]

other things, a random sampling of the actual underlying financial-asset files.⁹³ They will then contact the obligors listed in the files to confirm the existence of those financial assets. Additionally, they will review the company's reports of the historical and anticipated default rates on the underlying financial assets and try to ascertain that these rates are generally within the range of rates reported publicly for defaults on these types of financial assets.⁹⁴

On an ongoing basis after the transaction closes, the servicer will prepare periodic, usually monthly, servicer reports on the continuing performance of the financial assets. This report typically includes data regarding payments received on the financial assets, principal amounts that had defaulted, and the status of various reserves. Because the company itself or one of its affiliates usually acts as the servicer,⁹⁵ the servicer report will be reviewed by one or more independent due-diligence parties, usually the trustee, who may even try to verify certain data such as checking payment receipts on the financial assets against what is being reported as collected. To the extent there are any problems in performance of the financial assets or discrepancies between reported and actual data, the company will be contacted to understand why. Significant problems or discrepancies usually will trigger a termination of the transaction.⁹⁶

These due-diligence procedures are formidable, but they are not foolproof because they do not micromanage all uses and sources of cash and also because, as mentioned, the servicer is not usually independent of the company.⁹⁷ In the recent Student Finance Corporation ("SFC") fraud, for example, to disguise very high default rates on financial assets consisting of tuition-payment loans, SFC itself made payments on those loans from the proceeds of new securitization transactions—in effect, engaging

⁹³ It is usual to review only a random sampling where, as is customary, there are numerous small financial assets. [cite]

⁹⁴ [cite]

⁹⁵ [cite]

⁹⁶ [cite]

⁹⁷ See *supra* notes 94-96 and accompanying text.

in an undisclosed Ponzi scheme.⁹⁸ All of the due-diligence procedures described above had been performed, yet the fraud remained undiscovered for years.⁹⁹ In another recent fraud where (again) these due-diligence procedures had been performed, the company is alleged to have misled the due-diligence parties and investors by depositing money into the collection account on the monthly date that collections were actually tested and then withdrawing the money the day after.¹⁰⁰ Existing best-practice monitoring standards thus imperfectly protect investors from fraud.

The foregoing discussion has focused on failures resulting from the complexities of modern securities and their underlying assets. This article next discusses how the complexities of modern financial markets themselves can exacerbate these failures.

IV. COMPLEXITIES OF MODERN FINANCIAL MARKETS

The complexities of modern financial markets can aggravate the failures discussed above, in part because of the high sensitivity of markets to information.¹⁰¹ Financial markets rely critically on the supply of liquidity in the form of credit.¹⁰² The ability to contract for credit, in turn, depends on information not only about the economic health of the party seeking credit and its ability to repay (“counterparty risk”) but also about how the structure of the credit transaction more generally exposes the parties to risk.¹⁰³

⁹⁸ [cite]

⁹⁹ [cite]

¹⁰⁰ [cite to 7859]

¹⁰¹ [Examine the extent, if any, that complexities of modern financial markets can cause markets to fail even without any of the failures discussed in Parts II and III. cite1]

¹⁰² JOSEPH E. STIGLITZ & BRUCE GREENWALD, *TOWARDS A NEW PARADIGM IN MONETARY ECONOMICS* 142 (2003); MEIR KOHN, *FINANCIAL INSTITUTIONS AND MARKETS* 727 (1994).

¹⁰³ STIGLITZ & GREENWALD, *supra* note 102, at 142.

One such complexity stems from the “indirect-holding system” under which virtually all debt and equity securities are presently traded, with intermediary entities holding securities on behalf of investors. Issuers of the securities generally record ownership as belonging to one or depository intermediaries, which in turn record the identities of other intermediaries, such as brokerage firms or banks, that buy interests in the securities. Those other intermediaries, in turn, record the identities of investors that buy interests in the intermediaries’ interests.¹⁰⁴ This seemingly convoluted system has decisive advantages over a direct-holding system for securities: it reduces the costs of record-keeping and lowers the risk of loss occasioned by physically transferring securities.¹⁰⁵ Inadvertently, however, the indirect-holding system exacerbates uncertainty selection by reducing transparency: third parties cannot readily determine who ultimately owns, and thus has credit exposure to, specific securities because there is no single location from which third parties can easily get that information.¹⁰⁶

Furthermore, investors and other market participants often apply highly sophisticated mathematical techniques to attempt to quantify market variables. Although this often can increase investment precision, it sometimes can backfire. Professors Khandani and Lo have hypothesized, for example, that the subprime mortgage crisis resulted, at least in part, from a convergence in hedge-fund quantitatively-constructed investment strategies. They argue that when a number of hedge funds experienced unprecedented losses during the week of August 6, 2007, the hedge funds rapidly unwound sizable portfolios, likely based on a multi-strategy fund or proprietary-trading desk.¹⁰⁷ This unanticipated correlation of initial losses¹⁰⁸ then caused further losses by triggering stop/loss and de-leveraging policies.¹⁰⁹

¹⁰⁴ See Steven L. Schwarcz, *Intermediary Risk in a Global Economy*, 50 DUKE L.J. 1541, 1547-48 (2001).

¹⁰⁵ *Id.* at 1549.

¹⁰⁶ *Id.* at 1583.

¹⁰⁷ Amir Khandani & Andrew W. Lo, “What Happened to the Quants in August 2007” (Sept. 20, 2007) (SSRN working paper no. 1015987).

¹⁰⁸ [tie to discussion elsewhere of correlation-cite]

¹⁰⁹ Khandani & Lo, *supra* note 107.

Regardless of the extent that the subprime crisis might have resulted from a convergence in quantitatively-constructed investment strategies, the very existence of these strategies points out a broader potential to aggravate failure: that investments in financial markets are so tied to mathematical strategies that particular events can formulaically trigger massive sell-offs without parties having the time or opportunity to exercise judgment. This tight coupling of financial markets is itself a serious risk factor.¹¹⁰

Tight coupling is especially dangerous when combined with nonlinear feedback effects.¹¹¹ This danger is perhaps best exemplified by mark-to-market, or “fair value,” accounting. In its simplest form, this is the common requirement that a securities account be adjusted in response to a change in the market value of the securities. An investor, for example, may buy securities on credit from a securities broker-dealer, securing the purchase price by pledging the securities as collateral. To guard against the price of the securities falling to the point where their value as collateral is insufficient to repay the purchase price, the broker-dealer requires the investor to maintain a minimum collateral value. If the market value of the securities falls below this minimum, the broker-dealer will issue a “margin call” requiring the investor to deposit additional collateral, usually in the form of money or additional securities, to satisfy this minimum. Failure to do so triggers a default, enabling the broker-dealer to foreclose on the collateral.¹¹²

Requiring investors to “mark to market” in this fashion is generally believed to reduce risk.¹¹³ Nonetheless, it can cause “perverse effects on systemic stability” during

¹¹⁰ See *supra* note 14 and accompanying text.

¹¹¹ Nonlinearity results when “interactions among components of a system are not directly proportional.” Virginia R. Burkett et al., *Nonlinear Dynamics in Ecosystem Response to Climactic Change: Case Studies and Policy Implications*, 2 J. ECOLOGICAL COMPLEXITY 357, 359 (2005).

¹¹² ZVI BODIE, ALEX KANE & ALAN J. MARCUS, INVESTMENTS 78-79 (7th ed. 2008).

¹¹³ See, e.g., Gikas A. Hardouvelis & Panayiotis Theodossiou, *The Asymmetric Relationship Between Initial Margin Requirements and Stock Market Volatility Across Bull and Bear Markets*, 15 REV. FIN. STUD. 1525, 1554–55 (2002) (finding a correlation between higher margin calls and decreased systemic risk, and speculating that higher margin calls may bleed the irrationality out of the market until only sound bets are left).

times of market turbulence, when forcing sales of assets to meet margin calls can depress asset prices, requiring more forced sales (which, in turn, will depress asset prices even more), causing a downward spiral.¹¹⁴ The existence of leverage makes this spiral more likely and amplifies it if it occurs.¹¹⁵ At least some portion of the subprime crisis appears to have been caused by this downward spiral.¹¹⁶

Another way that the complexities of modern financial markets can aggravate failures is through human interactive behavior. When financial markets exhibit properties of a complex system, the ability to predict consequences, such as cause-and-effect explanations for market movements, is frustrated by nonlinear feedback effects arising from interactivities among market participants.¹¹⁷ For example, just a few years ago, home prices were described as overinflated in many markets due partially to lax lending standards that artificially fuelled demand for higher priced homes.¹¹⁸ At the same time, credit became increasingly available to less creditworthy borrowers as investors sought higher rates—arguably expecting home prices to continue to rise unabated.¹¹⁹ The

¹¹⁴ Rodrigo Cifuentes, Gianluigi Ferrucci, & Hyun Song Shin, *Liquidity Risk and Contagion 2* (working paper, Jan. 19, 2004, on file with author). See also Clifford De Souza & Mikhail Smirnov, *Dynamic Leverage: A Contingent Claims Approach to Leverage for Capital Conservation*, J. Portfolio Mgmt., Fall 2004, at 25, 28 (arguing that, in a bad market, short-term pressure to sell assets to raise cash for margin calls can lead to further mark-to-market losses for remaining assets, which triggers a whole new wave of selling, the process repeating itself until markets improve or the firm is wiped out; and referring to this process as a Critical Liquidation Cycle).

¹¹⁵ *Id.* at 26-27.

¹¹⁶ Rachel Evans, *Banks Tell of Downward Spiral*, 27 INT'L FIN. L. REV. (June 2008), at 16.

¹¹⁷ See NEIL F. JOHNSON, PAUL JEFFERIES, & PAK MING HUI, FINANCIAL MARKET COMPLEXITY 4 (2003) (also describing this as the difficulty of distinguishing exogenous from endogenous factors). Cf. BOOKSTABER, *supra* note 69, at 156 (observing that when market participants have a self-interest in gaming the system, it is all the more likely that an unanticipated crisis will arise).

¹¹⁸ Ted Cornwell, *Merrill Lynch Sees Credit Concerns Persisting in Mortgage Arena*, NAT'L MORTGAGE NEWS, May 30, 2005, at 15 (describing comments by Merrill Lynch analyst Kenneth Bruce that mortgage borrowers were “overleveraged” and that “creative financing” was driving overinflated home prices).

¹¹⁹ Tom Petruno, *Cheap Loans are Under Fire: Mortgage Companies Are on the Defensive for Loosening Credit Standards Amid the Housing Boom*, L.A. TIMES, Sept. 18, 2005, at C1 (explaining that mortgage lenders continued to loosen credit standards to

increasing availability of credit overinflated home prices even more, causing a greater-than-expected decline when the bubble burst.¹²⁰ In turn, this greater-than-expected decline in home prices not only caused mortgage owners to suffer greater-than-expected losses but also increased the rate of foreclosure, which itself further depressed home prices (causing mortgage owners to suffer even more).¹²¹

Another example of this nonlinear feedback effect is caused by the interactive nature of securities trading. Modern financial markets often feature quickly-adapting participants trading in sophisticated securities. This can frustrate stability, however—resulting in positive feedback loops and a failure of arbitrage price correction—when participants trade as much in reaction to the expected behavior and strategy of others as on their own information and analysis.¹²²

insure fee income and higher rates amid Fed rate hikes and skyrocketing home prices). *See also*, David Streitfeld, *It's Not a Bubble Until it Bursts: Although Ignoring Real Estate Bears Has Been Profitable Lately, Doom is Again on Some Lips*, L.A. TIMES, May 29, 2005 (describing participants in real estate markets as making investment decisions based primarily on their predictions of the behavior of other participants—namely mortgage lenders and home buyers).

¹²⁰ [cite]

¹²¹ Justin Lahart, *Ahead of the Tape*, WALL ST. J., Aug. 22, 2007, at C1 (observing that a dramatic tightening of standards by purchasers in the secondary mortgage market, after “rising default rates[,] led to steep losses” to mortgage owners).

¹²² *See supra* note 13 and accompanying text (noting that volatility and illiquidity can result from interactive behavior within markets). *See also* Lisa R. Anderson & Charles A. Holt, *Information Cascades in the Laboratory*, AM. ECON. REV., Dec. 1997, at 847 (describing experimental results involving an “information cascade” in which it is more “rational” for an individual to follow the decisions of others than to act on private information and analysis; this information cascade continues until some later player recognizes what has happened and deviates); Erik F. Gerding, *Laws Against Bubbles: An Experimental-Asset-Market Approach to Financial Regulation*, 2007 WIS. L. REV. 977, 984 (arguing that experimental asset markets are effective tools to evaluate the effectiveness of laws designed to limit market imperfections such as asset price bubbles in the context of complex adaptive markets); Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 49, at 4-5 (explaining that fund managers might still trade with an irrational herd rather than seizing the arbitrage opportunity because managers face greater scrutiny for betting against a herd, have finite employment horizons, and have investment expertise that rapidly depreciates in evolving financial markets).

Finally, the complexities of modern financial markets can aggravate failures through the interconnectedness of market participants. Financial institutions are often connected with one another through—and in that capacity, are characterized as “counterparties” to—derivatives contracts.¹²³ These financial instruments, most notably credit default swaps (CDS),¹²⁴ are used by institutions to hedge against the risk on their own investments.¹²⁵ Institutions sometimes also use them to earn fees for ensuring risk on another party’s investments.¹²⁶ Because of these interconnecting contracts, bankruptcy or other failure of a given market participant can cause that participant to default on its obligations to other market participants, who in turn—if the obligations in default are large enough—might default on their own obligations to market participants, leading to a domino-effect collapse.¹²⁷ Counterparty risk is further complicated by the lack of a formal trading system for these types of derivatives, which are simply contracts between private parties. The inability of market participants to know how much contingent exposure another participant might have on these contracts increases the uncertainty.

These risks came to a head with the recent Federal Reserve bailout of Bear Stearns. Among other concerns, Bear Stearns had a subsidiary hedge fund, which was believed to hold a large mortgage-backed securities portfolio of uncertain value.¹²⁸ At the same time, that subsidiary appeared to have significant exposure to other market

¹²³ [cite]

¹²⁴ In a credit default swap, one party (the credit “seller”) agrees, in exchange for the payment to it of a fee by a second party (the credit “buyer”), to assume the credit risk of certain debt obligations of a specified borrower or other obligor. If a “credit event” (for example, default or bankruptcy) occurs in respect of that obligor, the credit seller will either (a) pay the credit buyer an amount calculated by reference to post-default value of the debt obligations or (b) buy the debt obligations (or other eligible debt obligations of the obligor) for their full face value from the credit buyer. STRUCTURED FINANCE, *supra* note 31, §10:3.1.

¹²⁵ [cite]

¹²⁶ [cite]

¹²⁷ Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. __, __ (2008).

¹²⁸ [cite]

participants on CDS contracts.¹²⁹ The fear was that the subsidiary's assets would be insufficient to pay its liabilities on the CDS contracts.¹³⁰

The article next examines how failures resulting from complexity should be addressed.

V. ADDRESSING MARKET FAILURES RESULTING FROM COMPLEXITY

Complexity can add great efficiency and depth to financial markets, but it also can impair those markets by imposing high agency costs, increasing information asymmetries, and facilitating financial contagion. These failures, however, are more broadly driven by uncertainty of financial market decision-makers, nonlinear feedbacks and tight coupling that result in sudden, “unexpected,” and dramatic market changes, and misalignment of interests and incentives among market participants. From this perspective, the failures are similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects.¹³¹

¹²⁹ [cite]

¹³⁰ [cite] [Discuss also netting under ISDA forms of derivatives contracts, intended to mitigate counterparty risk. cite] In the United States, recent bankruptcy law changes are intended to further mitigate this risk by preventing an institution from “cherry-picking” favorable contracts with its derivatives counterparties. Edward R. Morrison & Joerg Riegel, *Financial Contracts and the New Bankruptcy Code: Insulating Markets from Bankrupt Debtors and Bankruptcy Judges*, 13 AM. BANKR. INST. L. REV. 641, 642 (2005). These bankruptcy law changes, which apply to derivatives contracts, modify § 365 of U.S. bankruptcy law under which entities in bankruptcy generally have the right to choose to continue with profitable contracts while terminating unprofitable contracts with the same counterparty. Morrison & Riegel, *supra* at 642, 647, 660, & 663.

¹³¹ The author makes this observation not only based on his experience and expertise as a finance lawyer and professor but also as a former engineer. *Cf.* Joseph H. Sommer, *Commentary: Where is the Economic Analysis of Payment Law?*, 83 CHI.-KENT L. REV. 751 (2008) (arguing that engineering principles apply to analyzing the law of payment systems); John Kambhu et. al., *Systemic Risk in Ecology and Engineering*, 13 FRBNY ECONOMIC POLICY REVIEW, No. 2, Nov. 2007, at 25 (observing that “several fields of engineering and science share with economics a keen concern with systemic risk”).

Of course, important differences exist between engineered systems and financial markets. Engineers and scientists often can perform real experiments, yielding results that may well be more precise than the results of empirical studies of financial markets. In part this is because interactive market behavior, in which “banks, consumers, firms, . . . investors [and other economic agents] continually adjust their market moves, buying decisions, prices, and forecasts to the situation these moves or decisions or prices or forecasts together create,” adds a “layer of complication . . . not experienced in the natural sciences” where reactions are simpler and more predictable.¹³² Engineers also often enjoy the luxury of being able to stop and restart a system.¹³³ Nonetheless, with appropriate discretion, significant engineering insights translate robustly to financial-market analysis.

Recognizing that “apparently there are no general laws for complexity [and so] one must reach for ‘lessons’ that might, with insight and understanding, be learned in one system and applied to another,”¹³⁴ the analysis below explores potential ways that market participants and regulators can attempt to retain the financial-market efficiency, sophistication, and depth afforded by complexity while reducing the potential for market failure. Because the fundamental nature of the failures examined in Parts II, III, and IV of this article cuts across specific factual patterns described in a given Part, the analysis is organized functionally by the nature of the failure, first addressing failures arising from uncertainty, then failures arising from nonlinear feedback and tight coupling, and finally failures resulting from conflicts and other forms of “misalignment.”

Addressing Information Failures Arising from Uncertainty:

¹³² Arthur, *supra* note 13, at 107.

¹³³ J. M. Ottino, *Engineering Complex Systems*, 427 NATURE, Issue no. 6873, Jan. 29, 2004, at 399.

¹³⁴ Nigel Goldenfeld & Leo P. Kadanoff, *Simple Lessons from Complexity*, SCIENCE, April 2, 1999, at __ (predicting an increasing study of complexity “with a view to better understanding” economic as well as physical and biological systems).

Uncertainty can cause a variety of financial-market failures, most obviously impairing securities disclosure.¹³⁵ This impairment reflects the engineering principle that where a system or structure is complex, the abstractions and simplifications needed to make its problems approachable can introduce significant uncertainty.¹³⁶ There are at least three possible ways to deal with this impaired disclosure: to tolerate it by relying on efficient-markets theory; to impose regulation proscribing transactions with impaired disclosure; to implement supplemental protections to minimize the impairment.¹³⁷ I have shown that toleration does not work because impaired disclosure makes securities markets inefficient.¹³⁸ Because complexity is not an end in itself but usually is a by-product of such salutary goals as seeking to transfer risk to parties better positioned to hold the risk and reducing the cost of funding businesses,¹³⁹ proscribing transactions with

¹³⁵ See *supra* notes 49-58 and accompanying text (discussing, among other things, that complexity increases the cost of analyzing and valuing securities, and that at some point the cost increase can exceed the benefit gained).

¹³⁶ MORGAN & HENRION, *supra* note 59, at 47. Uncertainty also might indicate randomness, or an inability to quantify probability. *Id.* at 63 (discussing the Heisenberg uncertainty principle in quantum mechanics, which holds that it is possible to know either the location or the momentum of a particle, but observing one property makes it impossible to observe the other). Sometimes systems might appear random, however, because of an incomplete understanding of the underlying processes. *Id.*

¹³⁷ In engineering too, designers of systems must choose to tolerate, eliminate, or provide supplement protections against undesirable byproducts. Cf. Nicholas A. Robinson, *Legal Systems, Decisionmaking, and the Science of Earth's Systems: Procedural Missing Links*, 27 *ECOLOGICAL L. Q.* 1077, 1108 (2001) (observing that the harmful exhaust produced as a byproduct by automotive internal combustion engines was tolerated because automobiles have become a transportation necessity but catalytic converters, which eliminate almost 90% of unwanted pollutants, were introduced as a supplemental protection); Dinmukhamed Eshanov, *The Role of Multinational Corporations From the Neoinstitutionalist and International Law Perspectives: The Concept of the Three-Level Game*, 16 *N.Y.U. ENVTL L.J.* 110, 123 (2008) (observing that despite growing evidence that chlorofluorohydrocarbons were creating a hole in the ozone layer, CFCs were not banned until a viable substitute was created).

¹³⁸ *Disclosure's Failure*, *supra* note 53, at __.

¹³⁹ See *supra* notes 6-10 and accompanying text. Even in Enron, complexity was not an end in itself but a (perhaps misguided) attempt to minimize financial-statement losses and volatility, accelerate profits, and avoid adding debt to its balance sheet which could have hurt Enron's credit rating and thereby damaged its credibility in the energy trading business. Schwarcz, *Enron and the Use and Abuse of Special Purpose Entities in Corporate Structures*, *supra* note 10, at 1309-10.

impaired disclosure would inadvertently ban many beneficial transactions.¹⁴⁰ If, as is likely,¹⁴¹ the benefits lost exceed the harm averted, proscription would not work. Efficiency demands that the costs of regulation do not exceed its benefits.¹⁴²

Implementing cost-effective supplemental protections therefore appears, by default, to be the best approach to the problem of impaired disclosure. These protections could include guaranties by sellers, such as warranties; governmental and private-sector certifications of quality; and reduction of conflicts of interest.¹⁴³

In a limited sense, a form of seller “guaranty” is being considered for financial markets by having underwriters of securities disclose that they hold (and intend to continue to hold) exposure to *pari passu* or subordinate positions in the securities being sold. In this way, the underwriter puts “skin in the game” to signal its belief in the safety of the securities.¹⁴⁴

¹⁴⁰ *Disclosure’s Failure*, *supra* note 53, at __.

¹⁴¹ *Id.* at __. Although I find it likely that proscribing transactions with impaired disclosure would inadvertently ban many beneficial transactions, actual empirical cost-benefit balancing is often impossible for anything but a trivial problem. Guido Calabresi, *Transaction Costs, Resource Allocation, and Liability Rules—A Comment*, 11 J. L. & ECON. 67, 70 (1968). Ultimately, regulators must make best guesses regarding the efficacy of proposed actions. *Id.*

¹⁴² See RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* § 1.2, at 13-14 (4th ed. 1992) (discussing this “Kaldor-Hicks” standard as the operating standard of efficiency). *Accord*, Louis Kaplow & Steven Shavell, *Fairness Versus Welfare*, 114 HARV. L. REV. 961, 1015 (2001). Cost-benefit balancing is also a well-recognized test for regulatory political viability. For example, before any major rule may take effect in the United States, regulatory agencies must submit a cost-benefit analysis to Congress. Congressional Review of Agency Rulemaking Act, Chap 8, USCA && 801-08.

¹⁴³ Schwarcz, *Disclosure’s Failure*, *supra* note 53, at __.

¹⁴⁴ Fitch Ratings Special Report, *Exposure Draft: Retaining Equity Piece Risk—Enhancing Transparency 2* (June 24, 2008) (seeking market feedback as to whether to invite key transaction parties to disclose whether they retain economic risk in the securities being sold). See also European Securities Market Expert Group, *Role of Credit Rating Agencies* (June 2008) (recommending that rating agencies disclose information regarding an originator’s or sponsor’s retained interest in securities). These approaches are not, of course, true guaranties because investors would have no claim for losses. For a suggestion, albeit unrealistic, that true guaranties be used, see Daniel Andrews, *The*

This approach, however, can sometimes backfire.¹⁴⁵ In the subprime mortgage crisis, for example, underwriters customarily purchased some portion of the subordinated “equity” tranches of ABS CDO securities to demonstrate their belief in the securities being sold.¹⁴⁶ Unfortunately, many of these underwriters did not fully understand the risks associated with their retained tranches, resulting in what can be called a “mutual misinformation” problem: by signaling its (unjustified) confidence in the securities being sold, the seller inadvertently misleads investors into buying those securities.¹⁴⁷ Mutual-misinformation problems are intractable almost by definition. Nonetheless, to the extent these problems are caused by the inherent uncertainty of securities being priced off quantitative models in the absence of an actual or active market,¹⁴⁸ the depth of the resulting losses in the subprime crisis suggests that investors, at least in the short term, are likely to avoid such reliance, obviating the need for a regulatory response.¹⁴⁹ Still, because investors over time tend to choose higher rates of return over investment discipline,¹⁵⁰ there may come a time when regulation, or its threat, is needed to restore that discipline.

Private-sector certifications of quality can also improve impaired securities disclosure, especially where the certification achieves an economy of scale. This approach is currently employed, for example, through rating-agency ratings on debt

Clean Up: Investors Need Better Advice on Structured Finance Products, 26 INT’L FIN. L. REV. 14, 14 (Sept. 2007).

¹⁴⁵ Fitch also notes, *supra* note 144 at 1, that there are “currently no data available to assess whether such retention or non-retention of equity piece risk actually has a greater impact on a transaction’s performance”).

¹⁴⁶ *Protecting Financial Markets*, *supra* note 3, at ___.

¹⁴⁷ This approach also could be misleading to the extent, for example, the retained securities bear higher interest rates than those being sold, compensating for the risk. Failure to disclose that higher rate, however, is likely to constitute securities law fraud, at least in the United States.

¹⁴⁸ *See supra* notes 79-81 and accompanying text.

¹⁴⁹ *Cf. infra* notes 229-230 and accompanying text (observing that investors tend, over time, to forsake investment discipline for higher rates of return).

¹⁵⁰ *See infra* note 230.

securities.¹⁵¹ In the subprime crisis, however, rating agencies were said to contribute to the crisis,¹⁵² and there are various proposals under consideration to improve the quality of the rating system.¹⁵³ Although it is too early to know the extent to which these proposals will improve the rating system, it is doubtful that any type of government certification would be more successful. In the United States, at least, private-sector analysts tend to be more capable and more accountable than government analysts due to the former's higher compensation incentives.¹⁵⁴

Finally, reducing conflicts of interest can mitigate problems of impaired securities disclosure to the extent such conflicts exacerbate the impairment.¹⁵⁵ This problem is primarily caused by agency-cost conflicts, where the interests of individuals conflict with the interests of the firms for which they work.¹⁵⁶ Securities analysts, for example, may be conflicted in this way when analyzing highly complex securities.¹⁵⁷ Such an analyst, if compensated by the number or amount of securities recommended for purchase, may be tempted to take shortcuts, such as resorting to heuristics.¹⁵⁸ This temptation is even more likely where the securities being recommended are of a type that others are recommending.¹⁵⁹ Similarly, certain losses of institutional investors in the subprime crisis appear to have resulted from losses in CDO investments by controlled or managed hedge

¹⁵¹ See *supra* note 70 and accompanying text (observing, among other things, that debt securities are rated by their likelihood of timely payment).

¹⁵² *Protecting Financial Markets*, *supra* note 3, at ___.

¹⁵³ *Id.* at ___. Cf. Richard Barley, *Ability to Track Risk Has Shrunk 'Forever'-Moody's*, REUTERS, Jan. 6, 2008 (explaining a statement by Moody's Investor Services that in the face of extreme complexity arising from financial innovation, the ability to track risk had been severely undermined, and that market participants should be required to hold additional capital).

¹⁵⁴ *Id.* at ___.

¹⁵⁵ The conflicts of interest discussed in the text above do not cause the impairment but merely exacerbate it. The impairment itself is caused by uncertainty.

¹⁵⁶ Most investors in securities are institutions. SEC Staff Report of the Task Force on Mortgage-Backed Securities Disclosure, *Staff Report: Enhancing Disclosure in the Mortgage Backed Securities Markets*, Jan. 2003, available at <http://www.sec.gov/news/studies/mortgagebacked.htm> (visited Feb. 23, 2008) (reporting that investors in mortgage-backed securities are "overwhelmingly institutional").

¹⁵⁷ See *supra* notes 56-58 and accompanying text.

¹⁵⁸ *Id.*

funds.¹⁶⁰ If managers of those hedge funds were paid according to hedge-fund industry custom—in which “fund managers reap large rewards on the upside without a corresponding punitive downside”¹⁶¹—they would have had significant conflicts of interest with the institutions owning the hedge funds. To mitigate agency-cost conflicts, individuals should be paid in a manner that better aligns their interests with the interests of the firms for which they work.¹⁶²

Restricting agency-cost conflicts is only a second-best solution to the problem of impaired securities disclosure.¹⁶³ There do not, however, appear to be any perfect solutions. Government already takes a somewhat paternalistic stance by mandating minimum investor sophistication for investing in complex securities, yet sophisticated investors and qualified institutional buyers (QIBs) are the very investors who lost the most money in the subprime financial crisis.¹⁶⁴ And any attempt by government to restrict

¹⁵⁹ Schwarcz, *Disclosure's Failure*, *supra* note 53, at ___.

¹⁶⁰ Kate Kelly, Serena Ng & David Reilly, *Two Big Funds At Bear Stearns Face Shutdown—As Rescue Plan Falts Amid Subprime Woes, Merrill Asserts Claims*, WALL ST. J., June 20, 2007, at A1.

¹⁶¹ James Surowiecki, *Performance-Pay Perplexes*, NEW YORKER, Nov. 12, 2007, at 34.

¹⁶² CRMPG III REPORT, *supra* note 55, at 5 (observing that “more can be done to ensure that incentives associated with compensation are better aligned with risk taking and risk tolerance across broad classes of senior and executive management”).

¹⁶³ Restricting such conflicts also would not solve the problem that, even absent conflicts, individuals might have insufficient incentives to try to completely understand the highly complex transactions in which they recommend their firms invest. Such individuals might, for example, view the possibility of losses as remote, or anticipate being in a new job if and when losses occurred, or simply feel safe following the herd of other bankers. Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 49, at 2, 14-15. Outside of an institutional-industry context, there may be further misalignment of incentives because of higher employee turnover. *Id.* at 14 (observing that employee turnover reduces accountability). Restricting conflicts of interest would also fail to solve the rational ignorance problem. *See supra* notes 52-53 and accompanying text (discussing the point at which the benefit of additional analysis might be outweighed by the cost of performing that analysis).

¹⁶⁴ *See, e.g.*, Jenny Anderson, *Wall St. Banks Confront a String of Write-Downs*, N.Y. TIMES, Feb. 19, 2008, at C1 (reporting that “major banks . . . have already written off more than \$120 billion of losses stemming from bad mortgage-related investments”); Randall Smith, *Merrill's \$5 Billion Bath Bares Deeper Divide—After Big Write-Down Tied to Mortgage Debt, O'Neal Asserts Control*, WALL ST. J., Oct. 6, 2007, at A1 (reporting a total of \$20 billion in write-downs by large investment banks).

firms from engaging in complex transactions would be highly risky because of the potential of inadvertently banning beneficial transactions.¹⁶⁵

The discussion above addresses when uncertainty causes failure through impaired securities disclosure. Uncertainty also can cause failure when information about market participants is not made public. This is illustrated by counterparty risk among market participants on CDS and other derivatives contracts.¹⁶⁶ This risk is problematic because market participants are unable to discern how much contingent exposure their counterparties have to other market participants.¹⁶⁷ Counterparties can mitigate this risk by voluntarily disclosing their contingent liabilities on these contracts. Absent voluntary disclosure, regulation can be imposed to require counterparties to disclose these liabilities.

The extent to which such disclosure will prove useful is uncertain. Under generally accepted accounting principles (“GAAP”), counterparties are already required to disclose many of their contingent liabilities.¹⁶⁸ However, subtle judgment calls must be made as to how likely a contingency is to occur. If the likelihood is deemed higher than it actually is, market participants may unnecessarily avoid doing business with the

¹⁶⁵ See *supra* notes 139-141 and accompanying text.

¹⁶⁶ See *supra* notes 123-130 and accompanying text.

¹⁶⁷ See *supra* notes 127-128 and accompanying text.

¹⁶⁸ Contingent liabilities must be disclosed, at least in the footnotes to a firm’s financial statements, if the contingency is merely a “reasonable possibility.” ACCOUNTING FOR CONTINGENCIES, Statement of Financial Accounting Standards No. 5, at 6 (Fin. Accounting Standards Bd. 1975) (allowing only remote risks to remain undisclosed). Sarbanes–Oxley also attempts to maximize GAAP disclosure of contingent liabilities by amending § 13 of the Securities Exchange Act of 1934 (15 U.S.C. § 78m (2005)) to add a new subsection (j), requiring the SEC to issue “[f]inal rules providing that each annual and quarterly financial report required to be filed with the Commission shall disclose all material off-balance sheet transactions, arrangements, obligations (including contingent obligations), and other relationships of the issuer with unconsolidated entities or other persons, that may have a material current or future effect on financial condition, changes in financial condition, results of operations, liquidity, capital expenditures, capital resources, or significant components of revenues or expenses.” Sarbanes–Oxley Act § 401(j). [update this footnote-cite]

counterparty. But if the likelihood is deemed lower than it actually is, market participants may be under-pricing the risk of doing business with the counterparty.¹⁶⁹

Finally, it should be recalled that the indirect-holding system for securities increases uncertainty about market participants.¹⁷⁰ The proper response in this context is complicated by the fact that the indirect-holding system evolved to reduce the costs of record-keeping and to lower the risk of loss occasioned by physically transferring securities.¹⁷¹ Any approach to deviate from that system in order to reduce uncertainty would thus have to take into account the possibility of increasing record-keeping costs and losses—an analysis beyond the scope of this article. In another context, however, this article proposes that a firm should be able, at least during crises of investor confidence, to avoid having to mark its securities portfolio to market by fully disclosing its underlying asset portfolio.¹⁷² This same approach could be used to reduce uncertainty without needing to modify the indirect-holding system.

Addressing Failures Arising from Nonlinear Feedback and Tight Coupling:

Recall that when financial markets exhibit properties of a complex system, the ability to predict consequences, such as cause-and-effect explanations for market movements, is frustrated by nonlinear feedback effects arising from interactivities.¹⁷³ Nonlinear feedback is especially dangerous when combined with tight coupling.¹⁷⁴

¹⁶⁹ Another possible approach to mitigate counterparty risk might be for CDS contracts, which have many characteristics of insurance (STRUCTURED FINANCE, *supra* note 31, §10:4.1), to be regulated like insurance policies. This approach is beyond this article's scope.

¹⁷⁰ See *supra* note 106 and accompanying text (observing that third parties cannot readily determine who owns, and thus has credit exposure to, specific securities because there is no single location from which they can easily get that information).

¹⁷¹ See *supra* note 105 and accompanying text.

¹⁷² See *infra* notes 182-184 and accompanying text.

¹⁷³ See *supra* notes 116-122 and accompanying text. It is less useful to try to determine which is the cause and which is the effect than to try to understand the interactive patterns and potential feedback effects.

¹⁷⁴ See text accompanying note 111, *supra*.

Currently, the most significant such combination is marking to market.¹⁷⁵ Although marking to market generally stabilizes financial markets by creating trust that assets are fairly valued, it destabilizes markets when investors lose confidence during times of market turbulence; then, requiring firms to sell assets to meet margin calls can artificially depress asset prices, causing a downward spiral.¹⁷⁶

This type of interactive complexity has led some to argue that quantitative tools should be augmented to perceive and account for the “observable and systematic” behavioral patterns that emerge as usually diverse market segments begin moving in lock-step, or where investors exhibit herding behavior.¹⁷⁷ In the case of marking to market, one way to account for the interactive pattern is to recognize, as the subprime mortgage crisis has revealed, that liquidity and default are not always correlated.¹⁷⁸ In that crisis, holders of securities that were unaffected by defaults found it difficult to sell or refinance those securities.¹⁷⁹ This difficulty in turn created an even greater crisis of confidence, causing the market to collapse.¹⁸⁰ At least part of the problem was caused by the requirement that firms sell the securities as market prices drop, causing prices to drop further.¹⁸¹

¹⁷⁵ See *supra* notes 111-116 and accompanying text.

¹⁷⁶ See *id.* [To what extent, if any, can (or should) this mark-to-market dichotomy between stabilizing markets and the downward spiral be modeled as a system with feedback loops? If the feedback dampens perturbations, the system will be stabilized. This occurs during normal times. But if the feedback amplifies perturbations, the system will become un-stabilized. This occurs when investors lose investor confidence. cite and compare May 12, 2008 Guide Post blog: “Is the Securitization Crisis Driven by Nonlinear Systemic Processes?”]

¹⁷⁷ Alan Greenspan, *We Will Never Have a Perfect Model of Risk*, FIN. TIMES, Mar. 17, 2008, at 9.

¹⁷⁸ See, e.g., Dr. Alexander Dibelius, Chairman, Goldman Sachs Deutschland, Address at the International Berlin Business and Trade Law Conference, Humboldt University (June 12, 2008) (notes on file with author) (observing that liquidity and default are not necessarily correlated).

¹⁷⁹ See, e.g., *Bank of New York v. Montana Bd. Of Investments*, [2008] E.W.H.C. 1594 (Ch.) (observing, at [cite], that extreme illiquidity in the structured products markets reduced the value of the (largely non-defaulted) collateral to significantly less than the present value of the collateral’s expected cash flows).

¹⁸⁰ Dibelius, *supra* note 178.

¹⁸¹ See *supra* notes 114-115 and accompanying text.

This downward spiral could have been mitigated, if not prevented, by recognizing that, during an investor crisis of confidence,¹⁸² marking to market can be misleading and potentially dangerous.¹⁸³ Firms then should be allowed to substitute other measures of investor comfort for marking to market. One possible approach, for example, is to allow a firm otherwise required to mark to market to have the option, instead, to disseminate full disclosure of its underlying asset portfolio.¹⁸⁴ For example, a firm that owns CDO securities could choose to disclose details about the mortgage loans and other financial assets underlying those securities in lieu of marking the securities to market,¹⁸⁵ thereby enabling investors and other market participants to make more transparent valuations. This approach also would help reduce the anomaly, seen during the subprime crisis, of securities bearing market values significantly lower than the present value, if known, of their reasonably expected cash flows.¹⁸⁶

As financial markets evolve, other nonlinear feedback effects will undoubtedly become tightly coupled in ways we cannot predict. Consideration therefore should be given to more broad spectrum solutions.¹⁸⁷ A possible approach, for example, is to establish an entity to act, if needed, as a liquidity provider of last resort in order to more loosely couple the feedback effects.¹⁸⁸ This approach takes inspiration from engineering

¹⁸² [Should “investor crisis of confidence” be the appropriate test and if so, how should it be ascertained? cite] *Cf.* Paul Krugman, *A Catastrophe Foretold*, NY TIMES, Oct. 26, 2007, at A25 (asserting that the downgrade of AAA bonds created a “crisis of confidence” in financial markets).

¹⁸³ CRMPG III REPORT, *supra* note 55, at 132-33.

¹⁸⁴ This “full disclosure” option has been proposed by Dr. Alexander Dibelius, *supra* note 178, and also by Donald S. Bernstein, Partner & head, Insolvency & Restructuring Practice Group, Davis Polk & Wardwell, in remarks at the International Insolvency Institute’s Eighth Annual International Insolvency Conference (June 10, 2008; notes on file with author). [expand discussion and analysis of full disclosure option. cite1]

¹⁸⁵ *See supra* note 28 and accompanying text (describing the assets that underlay CDO securities).

¹⁸⁶ *See supra* note 179.

¹⁸⁷ *Cf.* CRMPG III REPORT, *supra* note 55, at 102 (proposing that a resilient market for credit derivatives requires that shocks be “absorb[ed], rather than amplify[ied]”).

¹⁸⁸ For a detailed discussion of how a liquidity provider of last resort can be created and work, as well as an analysis of how related moral-hazard and taxpayer-cost concerns can

design, in which de-coupling system modularity helps to reduce the chance that a failure in one part of the system will trigger a failure in another part.¹⁸⁹ “Modularity allows complexity to become manageable by . . . partially closing off some parts of the system and allowing these encapsulated components to interconnect only in certain ways.”¹⁹⁰ Thus, when a component of a system fails, modularity enables repairs to be made before the entire system shuts down.¹⁹¹ In financial markets, liquidity works in the same way by mitigating the consequences of default and helping to assure a secondary market for investors who want to sell their securities.¹⁹² If a liquidity provider of last resort had been in existence when the subprime crisis started, the resulting credit-market collapse would either not have occurred or its impact would have been minimal.¹⁹³

Future study of nonlinear feedback effects in financial markets will almost certainly benefit from research in physics and ecosystem science, where a variety of modeling approaches have been employed to understand nonlinear interactive patterns.¹⁹⁴ For example, natural resource managers have been using models to analyze lake eutrophication, a process in which excess nutrients (such as phosphorous created by pollution) within the lake stimulate growth of aquatic plants, in turn causing rapid and

be alleviated, *see* Schwarcz, *Systemic Risk*, *supra* note 127, at ___. [Include some of that discussion in the above text. cite1. Also, compare the costs of a liquidity provider of last resort with the costs (per JS e-mail) of requiring capital for “near banks.” cite1]

¹⁸⁹ Charles B. Perrow, *Complexity, Catastrophe, and Modularity*, 78 *SOCIOLOGICAL INQUIRY*, Issue no. 2, at 162-73 (2008).

¹⁹⁰ Henry E. Smith, *Panel Four: Boilerplate Versus Contract: Modularity in Contracts: Boilerplate and Information Flow*, 104 *MICH. L. R.* 1175, 1180 (2006).

¹⁹¹ *Id.* *See also* Zuoyi Zhang & Yuliang Sun, *Economic Potential of Modular Reactor Nuclear Power Plants Based on the Chinese HTR-PM Project*, *NUCLEAR ENGINEERING & DESIGN* 2265 (2007) (explaining that, after the Three-Mile Island reactor meltdown, nuclear power plants began to use modularity to increase safety measures against similar, nonlinear catastrophes).

¹⁹² Schwarcz, *Systemic Risk*, *supra* note 127, at ___. *See also supra* note 102 and accompanying text (observing that markets rely critically on the supply of liquidity in the form of credit).

¹⁹³ Schwarcz, *Systemic Risk*, *supra* note 127, at __-__.

¹⁹⁴ *See, e.g.*, Burkett et al., *supra* note 111 (discussing research in ecosystem science that uses a variety of modeling approaches to understand nonlinear patterns).

cascading changes that ultimately deplete the lake’s dissolved oxygen.¹⁹⁵ Traditional linear models can significantly overstate acceptable phosphorous levels because such models disregard nonlinearities such as threshold and feedback effects.¹⁹⁶

Any attempt to regulate based on this research, however, should be approached with caution. An analysis based on models is dependent on the underlying assumptions, and we do not know enough about financial markets to be certain of the assumptions.¹⁹⁷ Furthermore, nonlinearity makes it more likely that regulation will lead to unintended consequences—consequences that sometimes can worsen the problem:

[The] natural reaction to market breakdown is to add layers of protection and regulation. But trying to regulate a market entangled by complexity can lead to unintended consequences, compounding crises rather than extinguishing them because the safeguards add even more complexity, which in turn feeds more failure.¹⁹⁸

Addressing Failures Arising from Misalignment:

Several types of misalignment give rise to financial-market failures. Consider first misalignment caused by the originate-and-distribute model, which can lead to moral hazard (which, in turn, is said to cause lax lending standards) and collective-action problems.¹⁹⁹ Because this model helps to efficiently allocate risk among commercial parties and is critical to the underlying funding liquidity of banks and corporations,²⁰⁰ this

¹⁹⁵ *Id.* at 360.

¹⁹⁶ *Id.*

¹⁹⁷ *Cf. supra* notes 80-81 and accompanying text (observing that, in the subprime crisis, the assumptions underlying valuation models for CDO and ABS CDO securities turned out to be wrong, triggering investor panic).

¹⁹⁸ BOOKSTABER, *supra* note 69, at 146. [In the context of unintended consequences, consider more generally the extent to which society should try to restrict steps that result in “tight coupling” of financial markets, such as the restrictions recently placed on naked shorting and the proposals that have been floated to limit sell-offs. For example, might these measures create a net social loss either by depressing the pricing functions of the market or simply delaying the inevitable? cite]

¹⁹⁹ *See supra* notes 41-47 and accompanying text.

²⁰⁰ *See supra* notes 19-26 and accompanying text.

article assumes that the basic model will, and indeed on a cost-benefit basis should,²⁰¹ continue notwithstanding its complexity. The article explores possible solutions on that basis.²⁰²

The moral hazard problem arises because the originate-and-distribute model misaligns the interests of the lenders with the interests of the ultimate owners of the loans.²⁰³ In theory, separation of origination and ownership should not matter because ultimate owners should assess and value risk before buying their ownership positions.²⁰⁴ Even though lenders are better situated to make this evaluation than the ultimate owners, the latter should take steps to reduce, or to compensate for, this information asymmetry.²⁰⁵ The subprime crisis demonstrates, however, that practice can diverge from theory in this context because of the complexity of disclosure, the tendency of investors to engage in herd behavior, and the possible excessive diversification of risk that undermines any given investor's incentive to monitor and see the big picture.²⁰⁶

One solution to the moral hazard problem caused by this misalignment is to require loan originators to retain some realistic risk of loss.²⁰⁷ This solution, though, would not necessarily apply to mortgage- and other loan-brokers, who sometimes work with banks and finance companies to help make loans to borrowers.²⁰⁸ Because these

²⁰¹ See *supra* note 142 and accompanying text.

²⁰² Cf. Lucian Arye Bebchuk, *A New Approach to Corporate Reorganizations*, 101 HARV. L. REV. 775, 776–77 (1988) (grafting a normative analysis onto a positive assumption, in that case taking the existence of corporate reorganizations in bankruptcy law as a given to put forth a suggestion to improve the reorganization process).

²⁰³ See *supra* notes 20–21 and accompanying text.

²⁰⁴ [cite]

²⁰⁵ [cite]

²⁰⁶ See *supra* note 43 and accompanying text. Cf. Schwarcz, *Protecting Financial Markets*, *supra* note 3 (examining why investors purchasing mortgage-backed securities failed to properly analyze disclosures or to police behavior of lenders and issuers).

²⁰⁷ *Id.* at ___. [expand by example and further analyze costs and benefits-cite] Cf. International Monetary Fund, *Global Financial Stability Report, Containing Systemic Risk and Restoring Financial Soundness*, at 81, April 2008, <http://www.imf.org/external/pubs/ft/gfsr/2008/01/index.htm> (last visited July 28, 2008) ([describe purpose of this cite]).

²⁰⁸ [cite]

“brokers” earn a fee by arranging the loans without putting any of their own funds at risk, they have little incentive to rigorously police credit standards.²⁰⁹ To the extent mortgage-broker participation causes lending standards to fall, however, that would be a somewhat straightforward “agency-cost” problem for lenders to solve.²¹⁰

Misalignment caused by the originate-and-distribute model also can create a collective-action problem when the ultimate owners of the loans are widely dispersed. This problem manifests itself most clearly in loan servicing.²¹¹ Theoretically this problem should be able to be alleviated by hiring competent “servicers” to service the loans on behalf of the owners, and indeed typical transactional documentation²¹² provides for hiring a servicer to act on behalf of the investors who beneficially own the loans.²¹³

In the subprime mortgage crisis, however, hiring servicers did not always solve the collective-action problem. Although servicers usually retained power, acting “in the best interests” of the investors in the mortgage-backed securities, to restructure the underlying mortgage loans,²¹⁴ in practice servicers were reluctant to engage in restructuring. There was uncertainty whether the servicer’s costs of engaging in a restructuring would be reimbursed, whereas all foreclosure costs are reimbursed.²¹⁵ More significantly, servicers often preferred foreclosure over restructuring because the former

²⁰⁹ Cf. Vikas Bajaj, *Inquiry Assails Accounting Firm in Lender’s Fall*, N.Y. TIMES, Mar. 27, 2008, at A1 (describing the “dodgiest mortgages” as resulting, at worst from, brokers marketing risky mortgages “aggressively, [and] sometimes unscrupulously”).

²¹⁰ [Expand this conclusion. cite]

²¹¹ See *supra* notes 45-46 and accompanying text.

²¹² This is usually in the so-called “pooling and servicing agreement.”

²¹³ It is also typical for originators of mortgage loans, or a specialized servicing company such as Countrywide Home Loans Servicing LP, to act as the servicer for a fee. JAMES A. ROSENTHAL & JUAN M. OCAMPO, *SECURITIZATION OF CREDIT: INSIDE THE NEW TECHNOLOGY OF FINANCE* 49-51 (1988) (explaining the general structure of a grantor trust when the originator of asset-backed securities services the pool of assets); Gretchen Morgenson, *Countrywide Is Upbeat Despite Loss*, N.Y. TIMES, Oct. 27, 2007, at C1 (reporting that Countrywide is the nation’s largest loan servicer).

²¹⁴ Gretchen Morgenson, *More Home Foreclosures Loom as Owners Face Mortgage Maze*, N.Y. TIMES, Aug. 6, 2007, at A1.

²¹⁵ *Protecting Financial Markets*, *supra* note 3, at ___.

is more ministerial and thus has lower litigation risk.²¹⁶ The litigation risk was exacerbated in the subprime crisis by the fact that, in many cases, cash flows deriving from principal and interest on the mortgages were separately allocated to different investor classes, or “tranches,” of the securities.²¹⁷ A restructuring that, for example, reduced the interest rate would adversely affect investors in the interest-only tranche,²¹⁸ leading to what some have called “tranche warfare.”²¹⁹

The collective-action problem, however, should be able to be managed. Parties should consider, for example, writing underlying deal documentation that sets clearer and more flexible guidelines, and ideally more certain reimbursement procedures, for loan restructuring—especially when such restructuring is superior to foreclosure.²²⁰ Investors (and servicers) should prefer foreclosure to restructuring if restructuring merely delays an inevitable foreclosure.²²¹

Misalignment can also cause failure in the form of fraud. This article has shown that current best-practice monitoring procedures in asset-backed securities transactions

²¹⁶ *Protecting Financial Markets*, *supra* note 3, at ___.

²¹⁷ Jon D. Van Gorp, “Capital Markets Dispersion of Subprime Mortgage Risk” 10 (unpublished Nov. 2007 manuscript, on file with author), at 7-8.

²¹⁸ The conflicts among tranches can become even more complicated because CDO and ABS CDO securities sometimes also include prepayment-penalty tranches, and the different tranches “have different priorities relative to one another for the purpose of absorbing losses and prepayments on the underlying subprime mortgage loans.” *Id.* at 8.

²¹⁹ Telephone Interview with Hirsch, *supra* note 43 (describing tranche conflicts as a significant reason why servicers choose foreclosure over restructuring).

²²⁰ In the current subprime crisis, of course, the underlying deal documentation is already in place. Because existing documentation cannot be easily renegotiated, the government might consider legislating changes. Any such changes that are subsidized in whole or part by government, however, could foster moral hazard, potentially making future homeowners more willing to take risks when borrowing.

²²¹ Misalignment also can result in a collective-action problem to the extent the originate-and-distribute model makes the size of any given loan-owner’s investment so small that it deprives owners of the incentive to engage in due diligence and monitoring. MARK ADELSON, *MBS BASICS* (Nomura Sec. Int’l 2006). This article’s proposal to require loan originators to retain some material exposure to risk, however, would help to solve this collective-action problem.

are not failsafe because the servicer is not usually independent of the company.²²² An affiliated servicer can manipulate monitoring in ways that are undetectable unless investors, or their agents, micromanage all uses and sources of cash.²²³

Misalignment that facilitates fraud can be addressed by either making the servicer independent of the company or by allowing investors, or their agents, to micromanage the uses and sources of cash. Because the servicer of the financial assets effectively manages uses and sources of cash collections from those assets, the apparent solution is simply to make the servicer independent.²²⁴

In practice, asset-backed securities transactions may evolve in the direction of using independent, third-party servicers in order to increase investor comfort.²²⁵ This solution is likely to be implemented gradually because, at least currently, few third parties have the needed servicing expertise and experience to cost-effectively perform in this capacity.²²⁶ Nonetheless, there is evidence that the market is beginning to respond,

²²² See *supra* note 95 and accompanying text.

²²³ See generally Part III.D, *supra*.

²²⁴ It will be interesting also to observe the extent to which investors gain comfort where the company is represented by a large, prominent, and highly respected law firm. The most agreed upon scholarly understanding of the value added by transactional lawyers is that, as repeat players in the transactional world, they add value by renting their good reputation to clients. This thesis of transactional lawyers as “reputational intermediaries” was first advanced in Ronald Gilson, *Value Creation by Business Lawyers: Legal Skills and Asset Pricing*, 94 YALE L. J. 239 (1984). See also Peter J. Gardner, *A Role for the Business Attorney in the Twenty-First Century: Adding Value to the Client’s Enterprise in the Knowledge Economy*, 7 MARQ. INTELL. PROP. L. REV. 17, 46-48 (2003); Karl S. Okamoto, *Reputation and the Value of Lawyers*, 74 OR. L. REV. 15, 43 (1995). The rationale is that the high-reputation law firm bonds itself to good performance, losing at least part of its reputation if it fails to perform well. Indeed, a high-reputation law firm adds the greatest relative value when the client does not already have a high reputation.

²²⁵ [cite]

²²⁶ [cite] Cf. STRUCTURED FINANCE, *supra* note 31, at ___ (observing that companies usually perform their own servicing in asset-backed securities transactions because of the cost of delegating servicing responsibility).

such as the recent decision by Bank of America to purchase Countrywide Financial Corp., partly in order to gain “greater scale in . . . servicing mortgages.”²²⁷

If the market begins to correct itself in this manner, there should be no need for regulation requiring the use of independent, third-party servicers in asset-backed securities transactions. Even if independent servicers are not always used, there is nothing intrinsically wrong or unusual for parties in business transactions to deal with each other on the basis of trust.²²⁸ Furthermore, regulation would be harmful to the extent it has the effect of rendering uneconomic those transactions that, even taking into account the increased possibility of fraud absent an independent servicer, would still be beneficial.²²⁹

The potential to ultimately impose regulation might nonetheless be valuable. In the current financial environment, investors may call for independent servicers, but investors tend to have short memories. Experience has shown that once a crisis recedes in memory, they will almost always tend to “go for the gold.”²³⁰ There may come a time when regulation, or its threat, is needed to restore market discipline.²³¹

²²⁷ Press Release, “Bank of America Agrees to Purchase Countrywide Financial Corp.,” Jan. 11, 2008.

²²⁸ Cf. T. Volery & S. Mensik, *The Role of Trust in Creating Effective Alliances: A Managerial Perspective*, 17 J. BUS. ETHICS 987 (1998) (observing that trust plays a crucial role in creating and managing alliances because it reduces complex realities far more quickly and economically than prediction, authority or bargaining).

²²⁹ Cf. *supra* note 142 and accompanying text (discussing cost-benefit analysis).

²³⁰ Larry Light, *Bondholder Beware: Value Subject to Change Without Notice*, BUS. WK., at 34 (Mar. 29, 1993) (“[b]ondholders can—and will—fuss all they like. But the reality is, their options are limited: higher returns or better protection. Most investors will continue to go for the gold.”) (discussing, in the context of but several years after the “Marriott split,” that investors favor higher interest rates over “event risk” covenants once examples of events justifying the covenants have receded in memory, even though they could reoccur). Psychologists label the tendency of people to overestimate the frequency or likelihood of an event when examples of, or associations with, similar events are easily brought to mind as the availability heuristic. Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Facts Versus Fears: Understanding Perceived Risk, in JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES* 463, 465 (Daniel Kahneman et al. eds., 1982).

²³¹ Compare *supra* notes 149-170 and accompanying text.

The foregoing discussion in this Part has analyzed how market failures resulting from complexity can be minimized. Although many failures can be alleviated without regulation,²³² there are areas in which regulation—or at least the threat of regulation—is desirable, if not necessary. For example, regulation can limit the extent to which an investor crisis of confidence causes markets to collapse by allowing portfolio disclosure as an alternative to marking to market.²³³ Regulation also can speed the adoption of desirable market changes—for example, by eliminating the time needed for existing contracts to be replaced.²³⁴ Similarly, as the lessons of the subprime crisis fade in the memories of investors, regulation might be needed to limit undue future reliance on mark-to-model valuation²³⁵ and to ensure that investors give appropriate consideration to the need for independent third-party servicing²³⁶ and avoid inappropriate exclusive reliance upon credit ratings.²³⁷ An important question, addressed below, is whether such regulation should be rules-based or principles-based.

Should Regulation be Rules-based or Principles-based?:

The argument in favor of regulation based on principles is that investment securities and financial markets constantly change, often unpredictably,²³⁸ and principles-based regulation is better suited to govern changing scenarios.²³⁹ Rules could be overly constraining or could simply lose their effectiveness.²⁴⁰

²³² This article proposes, for example, that servicing agreements be drafted with clearer and more flexible servicing guidelines, that firms compensate analysts in a manner that aligns their interests with those of the firm, that investors demand the use of independent third-party servicers, and that investors also require that loan originators retain a realistic risk exposure.

²³³ See *supra* note 184 and accompanying text.

²³⁴ See *supra* note 213 and accompanying text.

²³⁵ See *supra* note 149 and accompanying text.

²³⁶ See *supra* notes 230-231 and accompanying text.

²³⁷ See *supra* note 57 and accompanying text.

²³⁸ Cf. JOHNSON, JEFFERIES, & HUI, *supra* note 117, at ___ (noting that fluctuations in evolving financial markets are difficult to model *ex ante* because previously observed statistical patterns do not always continue).

²³⁹ [cite]

²⁴⁰ [cite]

Perhaps for this reason, the United Kingdom's Financial Services Authority (FSA) is moving to more of a principles-based approach.²⁴¹ Similarly, in the United States, the Financial Accounting Standards Board (FASB) is shifting GAAP from rules-based to more principles-based²⁴² and, to some extent, the emphasis of supervisory practices likewise appears to be shifting to a more principles-based approach.²⁴³

Principles-based regulation, however, is most appropriate in an “interpretive community” in which “the interpretive assumptions and procedures are so widely shared” by the regulator with the regulated parties (in our case, market participants) that the regulatory principles bear “the same meaning for all.”²⁴⁴ Without such shared assumptions and procedures, regulated parties will be unable to predict the consequences of their actions.²⁴⁵ Regulators need information from industry to remain relevant, just as industry needs information from regulators to remain compliant.²⁴⁶ To this end, “[m]any in the securities industry are calling for more principles-based regulation, linked with prudential oversight, to foster a consultative relationship between regulators and industry participants.”²⁴⁷

This suggests a potential dilemma: as investment securities and financial markets become increasingly internationalized and more complex, it will become increasingly harder for regulators and market participants to act together as a community. That, in

²⁴¹ FINANCIAL SERVICES AUTHORITY, PRINCIPLES-BASED REGULATION, FOCUSING ON THE OUTCOMES THAT MATTER (Apr. 2007).

²⁴² [cite]

²⁴³ CRMPG III REPORT, *supra* note 55, at 137.

²⁴⁴ Julia Black, *Using Rules Effectively*, in REGULATION AND DEREGULATION 95, __ (C. McCrudden ed., 1999).

²⁴⁵ *Cf.* comments of Eilis Ferran, Professor of Company and Securities Law, University of Cambridge Faculty of Law, at the University of Cambridge Conference on Principles v. Rules in Financial Regulation, April 12, 2008 (expressing concern that, because its strategy is to enforce on the basis of principles alone, the FSA's assurance that firms will find it possible to predict the consequences of their actions will be “just empty words”).

²⁴⁶ E-mail from Cristie Ford, Assistant Professor, University of British Columbia Faculty of Law and author of *New Governance, Compliance, and Principles-Based Securities Regulation*, 45 AM. BUS. L.J. 1 (2008), to the author (Apr. 19, 2008).

turn, will make principles-based regulation less effective.²⁴⁸ Regulators and market participants will have to remain cognizant of this limitation.²⁴⁹

VI. CONCLUSIONS

As the subprime mortgage crisis has dramatically illustrated, complexity can be both beneficial and harmful. It is beneficial to the extent it adds efficiency and depth to financial markets and investments, such as by satisfying investor demand for securities that more closely meet their investment criteria and by facilitating the transfer of risk to those who prefer to hold it.²⁵⁰ But it is harmful to the extent it triggers the market failures described in this article, “mak[ing] crises inevitable.”²⁵¹ Ultimately it is necessary to find a balance either through market adaptation or, if needed, regulation.

This article attempts to strike that balance. To this end, the article first examined the ways in which complexity can impair markets and investments. For example, the complexities of the assets underlying investment securities and the means of originating those assets can lead to a failure of lending standards. The complexities of investment securities themselves can lead to a failure of investing standards and financial-market practices by impairing disclosure, obfuscating the ability of market participants to see and judge consequences, and making financial markets more susceptible to financial contagion and to fraud. And the complexities of modern financial markets can exacerbate these market failures. Because these complexities are characteristic of complexities in nonlinear engineering systems, the article’s analysis draws in part on the literature analyzing these systems.

²⁴⁷ Elizabeth Derbes, “The Subprime Crisis: U.S. Regulatory Responses and Lessons Learned” ¶ V.B.3 (2008 unpublished manuscript, on file with author).

²⁴⁸ [consider providing examples from regulation proposed in this article. cite]

²⁴⁹ [cite—expand and develop this]

²⁵⁰ See *supra* notes 5-10 and accompanying text.

²⁵¹ BOOKSTABER, *supra* note 69, at 5.

The article offers no perfect solutions, and indeed some proposed solutions are no more than an overview. More detailed analysis would have to be more fact-specific because, with regulation, the devil is sometimes in the details.²⁵² Nonetheless, the solutions offered, along with the law and engineering approaches introduced, represent important first steps in helping to mitigate some of the harmful consequences of complexity without impairing the viability and importance of modern capital markets.

²⁵² [cite]