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Regulating Complexity in Financial Markets¹

Steven L. Schwarcz²

Abstract: As the financial crisis has tragically illustrated, the complexities of modern financial markets and investment securities can trigger systemic market failures. Addressing these complexities, this article maintains, is perhaps the greatest financial-market challenge of the future. The article first examines and explains the nature of these complexities. It then analyzes the regulatory and other steps that should be considered to reduce the potential for failure. Because complex financial markets resemble complex engineering systems, and failures in those markets have characteristics of failures in those systems, the article’s analysis draws on chaos theory and other approaches used to analyze complex engineering systems.

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¹ Copyright © 2009 by Steven L. Schwarcz. Early drafts of this article were titled *Complexity as a Catalyst of Market Failure*.

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I. INTRODUCTION

In a recent article, I examined financial-market anomalies and obvious market and regulatory protections that failed, seeking insight into the subprime financial crisis and its subsequent devolution into a larger global financial crisis.³ The crisis, I argued, can be attributed in large part to three causes: conflicts, complacency, and complexity.⁴ This

³ Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. 373 (Dec. 2008). This article refers to these crises collectively as the “subprime crisis.”

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. These causes also do not fully capture the problem of systemic risk, which can arise from a type of tragedy of the commons; because the benefits of exploiting finite capital resources accrue to individual market participants whereas the costs of exploitation, which affect the real economy, are distributed among an even wider class of persons, market participants have insufficient incentive to internalize their externalities. Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 206 (2008). Cf. Martin Hellwig, *Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis* 52 (Nov. 2008 preprint of the Max Planck Institute for Research on Collective Goods, Bonn, No. 2008/43), available at www.ssrn.com/abstract=1309442 (observing that “given the complexity and the fluidity of the network of interbank relations, there is no way in which the quantitative risk model of an individual bank could satisfactorily take account of the institution’s exposure to systemic risk”); Henry T.C. Hu, *Misunderstood Derivatives: The Causes of Informational Failure and the Promise of Regulatory Incrementalism*, 102 YALE L.J. 1457, 1502 (1993) (observing that “[g]overnment, rather than the private sector, has the incentive . . . to become informed about systemic risks”). Therefore, even in a simple financial system with no conflicts, no complacency, and no greed, systemic risk is theoretically possible absent regulation to address this collective-action problem. Steven L. Schwarcz, *Understanding the ‘Subprime’ Mortgage Crisis*, forthcoming S. C. L. REV. (2009)

article focuses on the third cause, complexity, which I regard as the greatest financial-market challenge of the future.⁵

Complexity in financial markets does not necessarily “arise for complexity’s sake, nor from a desire to obfuscate.”⁶ Rather, it arises in response to “demand by investors for securities that meet their investment criteria and their appetite for ever higher yields”⁷ and in order to facilitate the transfer and trading of risk to those who prefer to hold it, promoting efficiency.⁸ 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.⁹ Complex securities issued by special-purpose vehicles and

(Keynote Address, Law Review Symposium on the Subprime Mortgage Crisis), available at http://ssrn/abstract_id=1288687.

⁵ Cf. *Protecting Financial Markets*, *supra* note 3, at __ (concluding that “[s]olving problems of financial complexity may well be the ultimate twenty-first century market goal”). Although this article focuses on financial-market complexity, a related challenge is whether the increasing size and complexity of financial institutions causes corporate-governance failures. My Duke Law School colleague, Lawrence Baxter, has separately been examining that challenge.

⁶ Peter Green & Jeremy Jennings-Mares, Letter to the Editor, *FIN. TIMES*, July 4, 2008, at 14. At the margins, however, complexity may well arise for complexity’s sake or to obfuscate. Cf. Jonathan C. Lipson, “Failure’s Futures: Controlling the Market for Information in Corporate Reorganization” 67 (Aug. 9, 2008) (unpublished manuscript, on file with author) (arguing that complexity may “breed[] opacity” that allows people to “gain at the expense of others” rather than merely making markets efficient, and characterizing the trend towards inefficient complexity as the problem of “transactional entropy”).

⁷ Green & Jennings-Mares, *supra* note 6. The supply-side of this investor demand is that financial innovators likewise see customized financial products as a means of staying competitive, by “constantly introduce[ing] new financial products when [profit] margins on products decline quickly.” Hu, *supra* note 4, at 1479 (citations omitted).

⁸ 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).

⁹ Bethel & Ferrel, *supra* note 8, at 7.

backed by pools of financial assets¹⁰ 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.¹¹ Complexity thus can add efficiency and depth to financial markets and investments.

Nonetheless, complexity can also impair markets and investments in several interrelated ways. Part II.A of this article examines how complexities of the assets underlying modern investment securities and the means of originating those assets can lead to a failure of lending standards and unanticipated defaults. Complexity in this sense derives from complication, in that the intricate combining of parts increases the likelihood that failures will occur and diminishes the ability of investors and other market participants to anticipate and avoid these failures.¹² Part II.B of the article examines how 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 than, and can be valued above, the ratings and value of their

¹⁰ 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”).

¹¹ 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.

¹² 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”).

underlying assets.¹³ Complexity deriving from complication and valuation difficulty can be thought of as cognizant complexity; things are just too complex to understand.¹⁴

Part II.C of the article next examines how complexities of modern financial markets can exacerbate these failures. For example, markets consisting of securities that pool together multiple classes of assets can create a “complex system” in which price volatility and liquidity are nonlinear functions of patterns arising from the interactive behavior of many independent and constantly adapting market participants.¹⁵ This not only can produce cognizant complexity¹⁶ but also a “tight coupling” within credit markets in which events tend to move rapidly into a crisis mode with little time or opportunity to intervene.¹⁷ This additional nature of complexity is temporal¹⁸; in a complex system, signals are sometimes inadvertently transmitted too quickly to control.¹⁹

¹³ See *infra* note 47.

¹⁴ See *Understanding the ‘Subprime’ Mortgage Crisis*, *supra* note 4.

¹⁵ Cf. P.G. DRAZIN, *NONLINEAR SYSTEMS* 12 (1992) (observing that nonlinear systems represent “a feedback loop in which the output of an element is not proportional to its input”).

¹⁶ Cf. Jason Kravitt, *Foreword: Some Thoughts on What Has Happened to the Capital Markets and Securitization and Where Securitization is Going*, at 9 (2008), www.pli.edu/public/17984/foreword.pdf (observing that “the more complicated a system becomes, and the more interconnected, . . . the odds of a breakdown in a portion of the system increases (because of complexity)”).

¹⁷ I thank Rick Bookstaber for introducing the term “tight coupling,” originally borrowed from engineering nomenclature, to financial markets. See BOOKSTABER, *infra* note 70, at 144. Tight coupling is most pronounced when markets are illiquid and market participants are highly leveraged.

¹⁸ The effects of these types of complexity (i.e., cognizant and temporal) can combine, however, such as the cognizant complexity caused by the unexpected consequences of marking to market, which (like a complex engineering system subject to nonlinear feedback effects) resulted in a downward spiral of prices when marking to market occurred in unstable markets. See *infra* notes 121-124 and accompanying text.

¹⁹ *Understanding the ‘Subprime’ Mortgage Crisis*, *supra* note 4. Cf. 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).

Finally, Part III of the article analyzes possible solutions to these market failures. The failures have characteristics similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects, and indeed many characteristics of complex engineering systems are similar to those of financial markets.²⁰ This Part therefore examines solutions inspired by chaos theory, which helps to inform engineers about complex systems with nonlinear feedback effects.

Prescriptive regulation can begin to address existing market failures, but financial markets evolve so rapidly and often in such unexpected ways that prescriptive regulation can never address all potential failures. Prescriptive regulation also can sometimes create unintended, adverse consequences. Chaos theory addresses these dilemmas. Because failures are almost inevitable in complex systems, successful systems are those in which the consequences of a failure are limited. This can be done by de-coupling systems through modularity, helping to reduce the chance that a failure in one part of a complex system will systemically trigger a failure in another part.

To this end, Part III examines possible solutions, including creation of a market liquidity provider of last resort to provide functional modularity by limiting the consequences of financial-market failure. The costs of such a market liquidity provider (which could be largely privately funded) should be relatively minimal, especially compared with the costs of a lender of last resort to financial institutions—the role played by the U.S. Federal Reserve and foreign central banks. Had a market liquidity provider of last resort been in existence when the subprime crisis started, the resulting collapse of the credit markets may well have been restricted in scope and lessened in impact. Furthermore, by stabilizing financial markets, a market liquidity provider of last resort could minimize the quandary, increasingly faced during the subprime crisis, of a lender of last resort being forced to lend to financial institutions deemed “too big to fail.”

²⁰ 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*

II. COMPLEXITY CAN CAUSE MARKET FAILURES

This Part examines various ways in which complexity can cause market failures.

A. 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 and unanticipated defaults. Consider first the complexities of the underlying assets, which can include mortgage loans and a wide range of other financial assets.²¹ Each type of underlying asset requires a separate approach to modeling, 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).²² 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 to default.²³ These risks are also dynamic in that they fluctuate over time, and mathematical models that attempt to estimate the dynamic correlation are, at best,

Financial Markets, 46 J. FIN. 1839 (1991); BOOKSTABER, *infra* note 70 (drawing similar analogies).

²¹ Iacobucci & Winter, *supra* note 10, at 162.

²² 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.*

²³ MARK ADELSON, *MBS BASICS* (Nomura Sec. Int'l 2006) (describing the property of negative convexity in mortgage-backed securities).

approximations.²⁴ 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 generate incorrect data.²⁵ When multiple asset classes underlie a given class of securities, modeling can become exponentially complicated.

In addition to complex modeling, 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, purportedly in order to meet market demand.²⁶ These products included terms such as adjustable rates, low-to-zero down payment requirements, interest-only payment options, and negative amortization.²⁷ Because of this complexity, some borrowers did not fully understand the risks they were incurring²⁸ and, as a result, defaulted at a much higher rate than would be predicted by the historical mortgage-loan default rates relied on by loan originators in extending credit.²⁹

²⁴ 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).

²⁵ ADELSON, *supra* note 23.

²⁶ 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).

²⁷ *Id.* at 12.

²⁸ 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).

²⁹ 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

The complexities of the means of originating these assets also can lead to a failure of lending standards. For example, the originate-to-distribute model of mortgage lending,³⁰ under which mortgage lenders would sell off loans as they were made,³¹ is believed to have contributed to the subprime crisis.³² Third parties—including government-sponsored enterprises such as Federal National Mortgage Association (Fannie Mae) and Federal Home Loan Mortgage Corporation (Freddie Mac), direct government entities such as the Government National Mortgage Association (Ginnie Mae), and private investment banks—would purchase the loans and package them into mortgage-backed securities, or “MBS.”³³ This “securitization” process increased the accessibility and affordability of mortgage lending by indirectly funding such lending through the capital markets.³⁴ Nonetheless, because the interests of the lenders were no longer aligned with the interests of the owners of the loans (the investors in the MBS effectively becoming owners of the loans³⁵), there is concern that the originate-to-distribute model fostered moral hazard on the part of the lenders,³⁶ resulting in lax lending standards.³⁷

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).

³⁰ This model is also referred to as “originate-and-distribute.”

³¹ 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.

³² *See, e.g.*, Gary B. Gorton, “The Panic of 2007,” NBER Working Paper 14358 (2008), at 68 (stating that the originate-to-distribute model is the “dominant explanation” for the financial panic). *But cf.* Effi Benmelech, Jennifer Dlugosz, & Victoria Ivashina, “What Lies Beneath: A Look Inside CLO Collateral,” available at http://ssrn.com/abstract_id=1344068 (finding, empirically, that bank loans that are securitized perform no worse than bank loans that are held).

³³ Gorton, *supra* note 32, at 68.

³⁴ *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).

³⁵ These securities are discussed *infra* notes 37-22 and accompanying text.

³⁶ 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.

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 securities³⁸—did not impose on the originator the same strict lending standards that they would otherwise observe but for the separation of origination and ownership.³⁹ 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-to-distribute model makes it difficult for those owners to always see the big picture.⁴⁰ Like the fable of a blind person describing an elephant by touching only a part,

Hallinan, *The “Fresh Start” Policy in Consumer Bankruptcy: A Historical Inventory and an Interpretive Theory*, 21 U. RICH. L. REV. 49, 84 (1986).

³⁷ 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-to-distribute model of lending, lending standards shifted from evaluating the likelihood of repayment to evaluating the likelihood that the loan could be sold); *How Lending Standard Changes Led to the Housing Boom/Bust*, THE BIG PICTURE, Oct. 21, 2008, <http://bigpicture.typepad.com/comments/2008/10/why-lending-sta.html> (arguing that originators tried to find borrowers who could afford the low “teaser” rates for a few months, which led to the implosion of 293 mortgage lenders).

³⁸ 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).

³⁹ Most investors in securities are sophisticated 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”).

⁴⁰ See, e.g., Telephone Interview with Alan Hirsch, Director, North Carolina Policy Office (Feb. 20, 2008) (observing that the originate-to-distribute model made the structure “so complex that no one followed the trail”); Dugan Speech, *supra* note 37 (arguing that investors were unable to fully understand the complicated securities they bought).

⁴¹ owners often focused on isolated aspects of the market. Separating the ultimate owners also can create a collective-action problem when those owners are widely dispersed.⁴² 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.⁴³ Furthermore, to the extent an originate-to-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.⁴⁴

The foregoing discussion focused on complexities of the assets underlying modern securities and the means of originating those assets. The next discussion focuses on complexities of the securities backed by these assets.

B. Complexities of Modern Investment Securities

The complexities of modern investment securities can lead to a failure of investing standards and financial-market practices for several reasons: these complexities impair disclosure; they obscure 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.

To provide perspective, the subprime crisis involved complex forms of mortgage-backed securities. In their simplest form, these securities are typically issued through special-purpose vehicles (“SPVs,” sometimes called special-purpose entities, or “SPEs”), and payment on such securities derive principally or entirely from the mortgage loans owned by the SPVs. More complex forms of MBS include CDO, or “collateralized debt

⁴¹ Godfrey Saxe, *The Blindmen and the Elephant*, Poem (based on a South Asian parable).

⁴² Schwarcz, *Protecting Financial Markets*, *supra* note 3, at ___.

⁴³ *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).

⁴⁴ See *infra* note XX and accompanying text.

obligation,”⁴⁵ securities backed by—and thus whose payment derives principally or entirely from—a mixed pool of mortgage loans and other financial assets owned by SPVs⁴⁶; and ABS CDO securities backed by a mixed pool of mortgage- and other asset-backed securities. The classes, or “tranches,” of these securities are typically ranked by seniority of payment priority, with the highest priority classes being called senior securities, lower priority classes usually being called mezzanine securities, and the lowest-priority class, which has a residual claim against the SPV, being called the equity.⁴⁷ The senior and many of the subordinated classes of these securities are more highly rated than the quality of the underlying mortgage loans.⁴⁸

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 generally known as “asset-backed securities,” and the process of creating and issuing asset-backed securities generally known as “securitization”⁴⁹),⁵⁰ the potential of these complexities to impair disclosure, to obscure the ability of market participants to see and judge consequences,

⁴⁵ There are even more arcane variations, such as CDOs “squared” or “cubed,” but they go beyond this article’s analysis.

⁴⁶ 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.

⁴⁷ *Protecting Financial Markets*, *supra* note 3, at ___.

⁴⁸ 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. *Protecting Financial Markets*, *supra* note 3, at ___.

⁴⁹ Securitization generally means the process of turning financial assets into securities issued by an SPV. Schwarcz, *The Alchemy of Asset Securitization*, *supra* note 8, at 135.

⁵⁰ STEVEN L. SCHWARCZ, *STRUCTURED FINANCE, A GUIDE TO THE PRINCIPLES OF ASSET SECURITIZATION* §1:1 at 1-2 (3d ed. & supps. 2006) (hereinafter, “STRUCTURED FINANCE”) (discussing securitization as a dominant means of financing in the United States and abroad).

and to make financial markets more susceptible to financial contagion and fraud goes beyond mortgage-backed securities and the subprime crisis.

Complexities of Securities Can Impair Disclosure. Complexity can deprive investors and other market participants of the understanding needed for markets to operate effectively.⁵¹ Even if all information about a complex structure is disclosed,⁵² complexity increases the amount of information that must be analyzed in order to value the investment with a degree of certainty. This additional analysis entails higher cost.⁵³ 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.⁵⁴ 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.⁵⁵

Prior to the subprime crisis, for example, except for anticipating quite how profoundly home prices would drop, virtually all of the risks giving rise to the collapse of

⁵¹ See generally Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILL. L. REV. 1.

⁵² 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. In practice, though, “[m]any investors do not possess the resources to fully analyze complicated structured products.” Kravitt, *supra* note 16, at 18.

⁵³ 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).

⁵⁴ 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 51, at ___ (explaining why institutional investors face declining incentives to hire experts to parse information relating to structured products as those products increase in complexity).

⁵⁵ Steven L. Schwarcz, *Disclosure’s Failure in the Subprime Crisis*, 2008 UTAH L. REV. 1109, [pinpoint cite] (2008).

the market for securities backed by subprime mortgages appear to have been disclosed.⁵⁶ Investors did not, however, always appreciate these risks, in large part because the complexity of these securities made the risks very difficult to understand.⁵⁷ The prospectus itself in a typical offering of these securities can be hundreds of pages long.⁵⁸ 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.⁵⁹ 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.⁶⁰

⁵⁶ *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 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.”).

⁵⁷ 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”).

⁵⁸ The disclosure documents ordinarily consist of a prospectus and a prospectus supplement, each close to two-hundred pages long.

⁵⁹ Investment managers who are compensated by the number or amount of securities recommended for investment may be especially tempted to do this, particularly if the securities being recommended are of a type that others are recommending. Schwarcz, *Disclosure’s Failure*, *supra* note 55, at ___. *Cf.* Shah & Oppenheimer, *supra* note 53, 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).

Although the use of heuristics might be efficient overall in certain applications, heuristic reasoning can sometimes expose analysis to bias and systematic error.⁶¹ 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.⁶²

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.⁶³ In the subprime crisis, for example, 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.⁶⁴ Few, not even rating agencies, saw this correlation.⁶⁵ Although in

⁶⁰ *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 given rating, which is why they snapped up complicated securities tied to subprime mortgages”).

⁶¹ 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).

⁶² *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).

⁶³ *Cf.* Hu, *supra* note 4, at 1480 (observing in a derivatives context that “[t]he complexity can overwhelm even experts”). 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).

⁶⁴ Schwarcz, *Protecting Financial Markets*, *supra* note 3, at ____.

⁶⁵ *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.

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, investors failed to recognize an underlying correlation between mobile home loans and the price of oil. An oil boom in Oklahoma drew an influx of oil workers, creating the nation's 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.⁶⁶

The loan servicing problem likewise results from the complexity of securities obfuscating consequences.⁶⁷ 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.⁶⁸

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.⁶⁹ 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

⁶⁶ 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).

⁶⁷ See *infra* notes 276-279 and accompany text.

⁶⁸ See *infra* note 279 and accompanying text (discussing “tranche warfare”).

⁶⁹ Richard Bookstaber, *The Myth of Non Correlation*, INSTITUTIONAL INVESTOR, Sept. 2007, at 82.

market movements cannot be used to predict the payoff if the market moves dramatically.⁷⁰

Finally, the complexities of securities can obfuscate consequences when trying to assess investment risk. Investment analysts may well be able to intuit this risk, but—with limited time available to devote to risk assessment—a firm’s senior managers often want risk to be modeled and reduced to useable numbers.⁷¹ Any model, however, can be manipulated. For example, VaR, or value-at-risk, is presently the most widely-used model for reducing investment risk to a number.⁷² As the VaR model became more accepted, banks began compensating analysts not only for generating profits but also for generating profits with low risks, measured by VaR.⁷³ Analysts therefore began to refocus investment portfolios to concentrate more on securities, such as MBS and credit-defaults swaps, that generate gains but only rarely have losses.⁷⁴ Because the likelihood of these losses was less than the risk percentages taken into account under VaR modeling—which typically excludes losses that have less than a one-percent (or, in some cases, five-percent) likelihood of occurring within the model’s limited time frame—such losses were not included in the VaR computations.⁷⁵ Analysts knew but did not always make clear to senior management that in the rare cases where such losses occurred, they would be huge.⁷⁶

Complexities of Securities Can Make Financial Markets More Susceptible to Financial Contagion. The complexities of securities can make financial markets more

⁷⁰ RICHARD BOOKSTABER, *A DEMON OF OUR OWN DESIGN: MARKETS, HEDGE FUNDS, AND THE PERILS OF FINANCIAL INNOVATION* 156 (2007). My work in this article is inspired in part by this excellent book.

⁷¹ Joe Nocera, *Risk Mismanagement*, N.Y. TIMES, Jan. 4, 2009 (Sunday magazine), at 24.

⁷² *Id.* at 26.

⁷³ *Id.* at 46.

⁷⁴ *Id.* For an explanation of credit-default swaps, see *infra* notes 132-135 and accompanying text.

⁷⁵ Nocera, *supra* note 71, at 46. It is ironic that the VaR model explicitly excludes low probability events without regard to consequences of the events occurring, given Professor Hu’s observation that ignoring such “threshold effects” is not always economically rational. Hu, *supra* note 4, at 1488.

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.⁷⁷ When those investment-grade tranches later lost money,⁷⁸ the resulting uncertainty caused investors to panic, fearing that other highly-rated securities could likewise default.⁷⁹

The complexities of securities also can make market problems more contagious. In the subprime crisis, for example, payment on many mortgage-backed securities was guaranteed by “monoline” insurers, or specialized financial insurance companies that 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

⁷⁶ Nocera, *supra* note 71, at 46.

⁷⁷ Investment grade technically means a rating of BBB- or better. Schwarcz, *supra* note 65, at 7. An investment-grade rating indicates that full and timely repayment on the securities should not be speculative. *See id.* at 7-8.

⁷⁸ *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).

⁷⁹ *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 judge quality, overall quality for goods might decline as the benefits of quality accrue to the statistical group rather than an individual seller).

and insure only securities that pass these tests.⁸⁰ In the subprime crisis, however, monolines did not always adequately stress-test for the scenario of rapidly falling house prices, as a result of which they were weakened by having 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.⁸¹ 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.⁸²

This is well exemplified by the resulting crisis in the auction-rate-note (“ARN”) market. ARNs are long-term debt securities with short-term resetting interest rates issued by municipalities, museums, schools, and similar entities.⁸³ Many ARNs are guaranteed by monoline insurers.⁸⁴ In February 2008, however, investors were able to find few buyers for their notes because potential buyers feared that the monolines, which also were insuring large amounts of securities backed by subprime mortgages, would default. Buyers started avoiding all ARNs, even those of strong issuers.⁸⁵

⁸⁰ *A Monoline Breakdown?*, ECONOMIST, Jul 28, 2007, at 79.

⁸¹ David Enrich & Peter Eavis, *More Subprime Pain in Store—UBS Write-Downs, Insurer Downgrades Point to More Unraveling*, WALL ST. J., Jan. 31, 2008, at __.

⁸² 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).

⁸³ Liz Rappaport & Kara Scannell, *Credit Crunch: Auction-Rate Turmoil Draws Watchdogs’ Scrutiny*, WALL ST. J., at C2 (Feb. 22, 2008).

⁸⁴ 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).

⁸⁵ *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”).

The complexities of securities also can contribute to contagion 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.”⁸⁶ Like all mathematical models, the models for valuing securities are based on assumptions.⁸⁷ If these assumptions turn out to be wrong, investors may lose confidence in the 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.⁸⁸

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.⁸⁹ To understand why, compare 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.⁹⁰ Although there

⁸⁶ Neil Shah, *Can Wall Street be Trusted to Value Risky CDOs?*, REUTERS, July 13, 2007, available at <http://www.reuters.com/article/reutersEdge/idUSN0929430320070713>.

⁸⁷ *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).

⁸⁸ 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).

⁸⁹ See *supra* note 46 and accompanying text (defining asset-backed securities).

⁹⁰ 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*

certainly have been frauds, like Parmalat, WorldCom, and Global Crossing, where the reality belied the company's reputation,⁹¹ reputation built up slowly is harder 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.⁹² 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.⁹³ A corporation's reputation for governance derives from the quality of management, which is tested and built up over time by individual managers.⁹⁴ When companies lack a good public reputation, they find it difficult if not impossible to issue bonds in the capital markets.⁹⁵

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

Governance on Firms' Credit Ratings, J. ACCT. & ECON. 42, 203-43 (2006) (finding that weak corporate governance results in poorer credit ratings).

⁹¹ Cf. David Simmons, *WorldCom's Convincing Lies*, FORBES, July 8, 2002, <http://www.forbes.com/2002/07/08/0708simons.html> (discussing the fraudulent public reputation built by WorldCom that allowed it to sell bonds that were not based on the real value and reputation of the company).

⁹² 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).

⁹³ 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).

⁹⁴ 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).

⁹⁵ See *supra* note 90 (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).

much more on the ability of the financial assets originated by the company to repay the securities.⁹⁶ Therefore, much is done to monitor those assets.⁹⁷

For example, under existing best-practice standards for monitoring,⁹⁸ 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.⁹⁹

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

⁹⁶ STRUCTURED FINANCE, *supra* note 50, at §3:1.

⁹⁷ 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.

⁹⁸ The Securities Act of 1933, 73 P.L. 22, 48 Stat. 74, codified at 15 U.S.C. §§ 77a et seq. (the “Securities Act”), imposes on underwriters civil liability for misstatements or omissions in the registration statement. Securities Act § 11(a)(5), codified at 15 U.S.C. 77k(a)(5). The statutory standard to establish due diligence defense is “that required of a prudent man in the management of his own property.” Securities Act § 11(c), codified at 15 U.S.C. 77k(c). The statutory standard was further elaborated by the SEC in Rule 176 (a multifactor test). 15 C.F.R. 230.176. *Escott v. BarChris Construction Corporation*, 283 F. Supp. 643 (S.D.N.Y. 1968), is the leading case on due diligence defense. *See, e.g.,* William K. Sjostrom, *The Due Diligence Defense Under Section 11 of the Securities Act of 1933*, 44 BRANDEIS L.J., 549 (2006).

⁹⁹ Sometimes, the due-diligence parties themselves look to independent third-party industry experts to perform a portion of this diligence on their behalf. *See, e.g.,* Robert W. Doty, *Issuer Due Diligence—Relying on Experts and Third Party Information* (presentation to California Debt & Investment Advisory Commission, 6th Annual Pre-Conference, Sep. 10, 2007), <http://www.treasurer.ca.gov/Cdiac/seminars/slides/20070910/doty.pdf> (last visited Aug. 27, 2008).

practices, collections practices, and credit underwriting practices for the financial assets. The due-diligence parties then review data provided by the company examining, among other things, a random sampling of the actual underlying financial-asset files.¹⁰⁰ 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.¹⁰¹

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,¹⁰² 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

¹⁰⁰ It is usual to review only a random sampling where, as is customary, there are numerous small financial assets. Kathleen C. Engel & Patricia A. McCoy, *Turning a Blind Eye: Wall Street Finance of Predatory Lending*, 75 FORDHAM L. REV. 2039, 2083 note 214 (2007), citing Bill Shepherd, *Perils and Phantasm: The Mortgage Securitization Boom Is Threatened by Recession, Legislation and Rate Change*, INVESTMENT DEALERS DIG., Feb. 3, 2003 (observing that when subprime residential mortgage-backed securities (RMBS) underwriters examine loan files manually, normally they “don’t do due diligence on every single loan in a pool; at most, they do a random sample of, say, 3% of the loans”).

¹⁰¹ See, e.g., *Unsafe and Unsound Investment Portfolio Practices*, O.C.C. BULL. 2002-19 (May 22, 2002), available at <http://www.occ.treas.gov/ftp/bulletin/2002-19.txt>.

¹⁰² Cf. STRUCTURED FINANCE, *supra* note 50, §4:5 at 4-10 (observing that companies usually perform their own servicing in asset-backed securities transactions because of the cost of delegating servicing responsibility).

actual data, the company will be contacted to understand why. Significant problems or discrepancies usually will trigger a termination of the transaction.¹⁰³

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.¹⁰⁴ 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 in an undisclosed Ponzi scheme.¹⁰⁵ All of the due-diligence procedures described above had been performed, yet the fraud remained undiscovered for years.¹⁰⁶ 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.¹⁰⁷ 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.

C. Complexities of Modern Financial Markets

¹⁰³ See, e.g., DEBORAH R. SEIFE, ET AL., FITCH RATINGS, ASSET-BACKED COMMERCIAL PAPER EXPLAINED 10 (Nov. 8, 2001), www.stern.nyu.edu/~igiddy/ABS/fitchabcp.pdf (explaining “transaction-specific” wind-down triggers, including breach of representation by a seller or servicer and deterioration of portfolio assets).

¹⁰⁴ See *supra* notes 101-103 and accompanying text.

¹⁰⁵ *In re Commer. Money Ctr., Inc. Equip. Lease Litig.*, 2006 U.S. Dist. LEXIS 21392 at 31-32 (N.D. Ohio, April 20, 2006), citing *MBIA Ins. Corp. v. Royal Indem. Co.*, 286 F. Supp. 2d 347, 349-55 (D. Del. 2003).

¹⁰⁶ *MBIA Ins. Corp. v. Royal Indem. Co.*, 286 F. Supp. 2d 347, 348, 350-51 (D. Del. 2003).

¹⁰⁷ [cite to 7859]

The complexities of modern financial markets can aggravate the failures discussed above, in part because of the information uncertainty and the high sensitivity of markets to information. Financial markets rely critically on the supply of liquidity in the form of credit.¹⁰⁸ 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.¹⁰⁹

One way in which markets per se create information uncertainty is 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.¹¹⁰ 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.¹¹¹ Inadvertently, however, the indirect-holding system exacerbates uncertainty 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.¹¹²

Furthermore, investors and other market participants often apply highly sophisticated mathematical techniques to attempt to quantify market information. Although this often can increase investment precision, it sometimes can backfire.

¹⁰⁸ JOSEPH E. STIGLITZ & BRUCE GREENWALD, TOWARDS A NEW PARADIGM IN MONETARY ECONOMICS 142 (2003); MEIR KOHN, FINANCIAL INSTITUTIONS AND MARKETS 727 (1994).

¹⁰⁹ STIGLITZ & GREENWALD, *supra* note 108, at 142.

¹¹⁰ See Steven L. Schwarcz, *Intermediary Risk in a Global Economy*, 50 DUKE L.J. 1541, 1547-48 (2001).

¹¹¹ *Id.* at 1549.

¹¹² *Id.* at 1583.

Professors Khandani and Lo have hypothesized, for example, that the subprime 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.¹¹³ This unanticipated correlation of initial losses¹¹⁴ then caused further losses by triggering stop/loss and de-leveraging policies.¹¹⁵

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.¹¹⁶

Information uncertainty, whatever its source, is especially dangerous when combined with nonlinear feedback effects and tight coupling¹¹⁷—a combination which inadvertently can be created or exacerbated by regulation.¹¹⁸ This is perhaps best exemplified by mark-to-market, or “fair value,” accounting. In its simplest form, this is

¹¹³ Amir Khandani & Andrew W. Lo, “What Happened to the Quants in August 2007” (Sept. 20, 2007) (SSRN working paper no. 1015987).

¹¹⁴ See *supra* notes 63-66 and accompanying text.

¹¹⁵ Khandani & Lo, *supra* note 113.

¹¹⁶ See *supra* note 17 and accompanying text.

¹¹⁷ 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).

¹¹⁸ BOOKSTABER, *supra* note 70, at 146 (observing that “the natural reaction to [financial] 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.”).

the common regulatory requirement¹¹⁹ 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.¹²⁰

Requiring investors to “mark to market” in this fashion is generally believed to reduce risk.¹²¹ Nonetheless, it can cause “perverse effects on systemic stability” during 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.¹²² The existence of leverage makes this spiral more

¹¹⁹ Accounting rules are a form of regulation, being promulgated (in the United States) by the Financial Accounting Standards Board pursuant to its delegation of authority from the Securities and Exchange Commission. FINANCIAL ACCOUNTING STANDARDS BOARD, *FACTS ABOUT FASB* (2002), at 1, *available at* http://www.fasb.org/facts/facts_about_fasb.pdf (discussing this delegation of regulatory authority).

¹²⁰ ZVI BODIE, ALEX KANE & ALAN J. MARCUS, *INVESTMENTS* 78-79 (7th ed. 2008).

¹²¹ *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).

¹²² 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).

likely and amplifies it if it occurs.¹²³ At least some portion of the subprime crisis appears to have been caused by this downward spiral.¹²⁴

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.¹²⁵ 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.¹²⁶ 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.¹²⁷ The increasing availability of credit overinflated home prices even more, causing a greater-

¹²³ *Id.* at 26-27.

¹²⁴ Rachel Evans, *Banks Tell of Downward Spiral*, 27 INT'L FIN. L. REV. (June 2008), at 16.

¹²⁵ 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); Thomas Lee Hazen, *The Short-Term/Long-Term Dichotomy and Investment Theory: Implications for Securities Market Regulation and for Corporate Law*, 70 N.C. L. REV. 137, 157 (1991) (observing that irrational investor behavior that interferes with market efficiency is sometimes referred to as “noise”). Cf. BOOKSTABER, *supra* note 70, 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).

¹²⁶ 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).

¹²⁷ 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 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).

than-expected decline when the bubble burst.¹²⁸ In turn, this greater-than-expected decline in home prices not only caused mortgage owners to suffer higher-than-expected losses but also increased the rate of foreclosure, which itself further depressed home prices (causing mortgage owners to suffer even more).¹²⁹

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.¹³⁰ An extreme form of this phenomenon can occur when investors make their investment decisions by anticipating what other investors will do.¹³¹

¹²⁸ *The Fed's Alibi*, WALL ST. J., Sept. 17, 2007, at A16 (arguing that the “Fed’s easy money policies helped cause the housing bubble and subprime crisis”).

¹²⁹ 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).

¹³⁰ See *supra* note 15 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 51, 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).

¹³¹ See, e.g., James Surowiecki, *Everyone's Watching*, NEW YORKER, Nov. 10, 2008, at 35 (observing that, “in an environment of profound uncertainty [as has happened in the subprime crisis], investors have a natural if troubling tendency to turn to [futures markets for, and foreign markets in, the same types of securities] as horoscopes,” thereby turning “investing [into] an exercise in anticipating what other investors will do”; and also

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.¹³² These financial instruments, most notably credit-default swaps (CDS),¹³³ are used by institutions to hedge against the risk on their own investments.¹³⁴ Institutions sometimes also use them to earn fees for ensuring risk on another party’s investments.¹³⁵ 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.¹³⁶ Counterparty risk—essentially an information failure caused by lack of transparency as to counterparty financial condition—is further complicated by the lack of a formal trading system for these types of derivatives, which are simply contracts between private parties.¹³⁷ The inability of market participants to know how

arguing that this tendency “can easily lead to contagion [because] selling in one market triggers selling in the next”).

¹³² PHELIM P. BOYLE & FEIDLIM BOYLE, *DERIVATIVES: THE TOOLS THAT CHANGED FINANCE* 7 (2001) (defining parties to a contract, especially a derivatives contract, as counterparties).

¹³³ 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 50, §10:3.1.

¹³⁴ Frank Packer & Haibin Zhu, Bank for International Settlements, *Contractual Terms and CDS Pricing*, *BIS QUARTERLY REV.* 89 (March 2005).

¹³⁵ Well over 90% of derivatives contracts are currently credit-default swaps. *See, e.g.*, Comptroller of the Currency, *OCC’s Quarterly Reports on Bank Derivatives Activities*, covering 1995-2008, available at <http://www.occ.treas.gov/deriv/deriv.htm> (last visited Aug. 27, 2008).

¹³⁶ *Systemic Risk*, *supra* note 4, at 198-200.

¹³⁷ CDS transactions are presently “over the counter,” meaning they are entered into contractually and not on an exchange.

much contingent exposure another participant might have on these contracts increases the uncertainty.

These risks came to a head with the Federal Reserve bailouts of Bear Stearns and AIG. Bear Stearns, for example, had a subsidiary hedge fund which was believed to hold a large mortgage-backed securities portfolio of uncertain value.¹³⁸ At the same time, that subsidiary appeared to have significant exposure to other market participants on CDS contracts.¹³⁹ The fear was that the subsidiary's assets would be insufficient to pay its liabilities on the CDS contracts.¹⁴⁰ Counterparty risk is also believed to be integral to the failure of credit markets in the subprime crisis.¹⁴¹

¹³⁸ See, e.g., *Turmoil in U.S. Credit Markets: Examining the Recent Actions of Federal Financial Regulators, Panel I of the hearing of the Senate Banking, Housing, and Urban Affairs Committee*, Federal News Service, April 3, 2008 (Statement of Sen. Charles Schumer (D-NY) that one of the reasons for Bear Stearns' failure was that "[t]wo of [Bear Stearns'] hedge funds went under due to mortgages in the summer").

¹³⁹ Cf. Testimony of Ben Bernanke, Federal Reserve Chairman, before the House Financial Services Committee, *Transcript of the Semiannual Humphrey Hawkins Hearing on Monetary Policy of the House Financial Services Committee*, Federal News Service, July 16, 2008 ("Part of the reason that it was a big concern to us when Bear Stearns came to the brink of failure was that we were concerned that there were various markets where the failure of a major counterparty would have created enormous strains to the financial system").

¹⁴⁰ David Henry, *Wall Street's Perfect Storm; Investors deal with a Lehman bankruptcy, the sale of Merrill Lynch to BofA, and a possible AIG restructuring*, BUS. WK, September 15, 2008, at [cite] ("[Treasury Secretary Paulson and Federal Reserve Chairman Bernanke] feared permitting Bear Stearns' bankruptcy would throw Wall Street into chaos because Bear had untold credit derivatives contracts in place with countless other banks and hedge funds"). Netting and, to a growing extent, collateral agreements are used to mitigate counterparty credit risks. Committee on Payment and Settlement Systems and the Euro-Currency Standing Committee of the Central Banks of the Group of Ten Countries, Bank of International Settlements, *Report on OTC Derivatives: Settlement Procedures and Counterparty Risk Management*, CGFS Publications No. 8, at 1 (Sep. 1998), available at <http://www.bis.org/publ/ecsc08.htm> (last visited Nov. 7, 2008). 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

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

III. ADDRESSING MARKET FAILURES RESULTING FROM COMPLEXITY

Complexity can add great efficiency and depth to financial markets, but it also can cause a multitude of market failures. These failures, however, fall into three broad categories: (A) failures, such as impaired disclosure, caused by information uncertainty; (B) failures, such as financial contagion and the inability to predict consequences, caused by nonlinearity and tight coupling; and (C) failures, such as moral hazard, servicer paralysis, and fraud, caused by conflicts and other forms of “misalignment.” The causes of these failures are similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects.¹⁴² Moreover, many characteristics of complex engineering systems are similar to those of financial markets.¹⁴³ For these

terminating unprofitable contracts with the same counterparty. Morrison & Riegel, *supra* at 642, 647, 660, & 663.

¹⁴¹ *Understanding the ‘Subprime’ Mortgage Crisis*, *supra* note 4.

¹⁴² I make this observation not only based on my 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”).

¹⁴³ Hsieh, *Chaos and Nonlinear Dynamics*, *supra* note 20. Financial markets originally were modeled as linear systems. The efficient capital market hypothesis (EMH), for example, posits that “the market prices securities as if there was a rational process, whether or not the market’s constituent actors qualify as rational.” Donald C. Langevoort, *Theories, Assumptions, and Securities Regulation: Market Efficiency Revisited*, 140 U. PA. L. REV. 851, 852 (1992). Another model, the random walk theory, is effectively a subset of the EMH because it “maintains that the market is efficient, with prices moving so rapidly in response to new information that investors cannot consistently buy or sell fast enough to benefit.” Thomas Lee Hazen, *The Short-Term/Long-Term Dichotomy and Investment Theory: Implications for Securities Market Regulation and for Corporate Law*, 70 N.C. L. REV. 137, 157 (1991). It is questionable, however, whether the EMH

reasons, this article will take into account, among other things, the “chaos theory” that helps to inform engineers about complex systems with nonlinear feedback effects.¹⁴⁴

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

validly describes markets for complex securities, since many legitimate transactions in which securities are issued are “so complex that less than a critical mass of investors can understand them in a reasonable time period [and to that extent] the market will not reach a fully informed price equilibrium, and hence will not be efficient.” Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 51, at 19. Moreover, the EMH does not appear to validly describe markets for debt securities. Even publicly-traded debt markets are not efficient. *See, e.g.*, Yedidia Z. Stern, *A General Model for Corporate Acquisition Law*, 26 J. CORP. L. 675, 709 (2001) (“studies show that the bond market is not efficient; and therefore, one cannot expect the market prices to compensate bondholders for the risks to which they are exposed”). Privately-traded debt markets may be even less efficient. *Camden Asset Mgmt., L.P. v. Sunbeam Corp.*, No. 99-8275-CIV, slip op. at 31-36 (S.D. Fla. July 3, 2001) (privately placed Rule 144A-exempt securities, being thinly traded, do not have an efficient market). It therefore is highly unlikely that the EMH validly describes markets for complex *debt* securities—the category that includes virtually all investment securities issued in securitization and other structured financing transactions (STRUCTURED FINANCE, *supra* note 50, § 1:1 at 1-5) and all of the securities involved in the subprime crisis (Schwarcz, *Protecting Financial Markets*, *supra* note 3, at __).

¹⁴⁴ Cf. Patrick J. Glen, *The Efficient Capital Market Hypothesis, Chaos Theory, and the Insider Filing Requirements of the Securities Exchange Act of 1934: The Predictive Power of Form 4 Filings*, 11 FORDHAM J. CORP. & FIN. L. 85 (2005) (discussing, in the context of the insider filings requirements of the securities laws, the extent to which chaos theory might inform financial market models) Lawrence A. Cunningham, *From Random Walks to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis*, 62 GEO. WASH. L. REV. 546, 593 (1994) (arguing that markets are nonlinear systems because “deeper structural phenomena” than information about asset values affect market movements). The disconnect between market prices and fundamental underlying asset values in the subprime crisis (*see infra* note 199) provided recent concrete evidence that financial markets have characteristics of nonlinear systems. Cf. Glen, *supra* at 99 (observing that such a disconnect would signal nonlinearity).

natural sciences” where reactions are simpler and more predictable.¹⁴⁵ Engineers also often enjoy the luxury of being able to stop and restart a system.¹⁴⁶ Nonetheless, with appropriate discretion, certain 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,”¹⁴⁷ 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 its market failures.¹⁴⁸ Because these failures can cut across the specific factual patterns identified in Part II, the analysis is organized functionally by the nature of each 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” that result from complexity.¹⁴⁹

A. Addressing Information Failures Arising from Uncertainty

¹⁴⁵ Arthur, *supra* note 19, at 107.

¹⁴⁶ J. M. Ottino, *Engineering Complex Systems*, 427 NATURE, Issue no. 6873, Jan. 29, 2004, at 399.

¹⁴⁷ 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).

¹⁴⁸ One reviewer of this article questions, as devil’s advocate, whether the subprime crisis has upset the very conception that, absent market failures, unrestrained financial markets are efficient. Because I have argued that several types of market failures—including complexity—in fact contributed to the subprime crisis (*see supra* notes 4-5 and accompanying text), I see no justification for that extreme position.

¹⁴⁹ This article does not purport to cover all types of conflicts that could cause market failure, just those that result from complexity. For a more complete discussion of conflicts that could cause market failure, *see Protecting Financial Markets, supra* note 3, at __, and Steven L. Schwarcz, *Conflicts and Financial Collapse: The Problem of Secondary-Management Agency Costs*, 26 YALE J. ON REG., Issue no. 2 (forthcoming Summer 2009) (symposium issue on the future of financial regulation), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1322536.

Uncertainty can cause a variety of financial-market failures, most obviously impairing securities disclosure.¹⁵⁰ 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.¹⁵¹ Assumptions made in civil engineering, for example, introduce uncertainties when assessing the strength of buildings and their potential to collapse.¹⁵² There are several potential ways to deal with this impaired disclosure: to tolerate it; to proscribe transactions with impaired disclosure or otherwise impose regulation attempting to reduce uncertainty; to implement supplemental protections to minimize the impairment.¹⁵³

Toleration would not work because impaired disclosure makes securities markets inefficient.¹⁵⁴ Proscribing transactions with impaired disclosure would not work because it inadvertently would ban many beneficial transactions.¹⁵⁵ Complexity is not an end in

¹⁵⁰ See *supra* notes 51-60 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).

¹⁵¹ MORGAN & HENRION, *supra* note 61, 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.*

¹⁵² See BILAL M. AYYUB, RISK ANALYSIS IN ENGINEERING AND ECONOMICS 28 (2003) (discussing fuzzy set theory as a method for addressing “[a]pproximations [that] arise from human cognition and intelligence . . . and result in uncertainty . . .”).

¹⁵³ 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 ECOLOGY 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 chlorofluorocarbons were creating a hole in the ozone layer, CFCs were not banned until a viable substitute was created).

¹⁵⁴ *Disclosure’s Failure*, *supra* note 55, at ___.

¹⁵⁵ *Disclosure’s Failure*, *supra* note 55, at ___.

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.¹⁵⁶ The harm averted by proscription would therefore likely exceed its benefits.¹⁵⁷

Other regulatory attempts to reduce uncertainty are also unlikely to work. Any such regulation would run into the conundrum that uncertainty can be irreducible, in that the abstractions and simplifications needed to make a complex system approachable can themselves introduce significant uncertainty.¹⁵⁸ For example, Professor Henry Hu has argued that regulators cannot keep up with development of complex derivatives products because academic publishing, in which such developments may first appear, “is not a timely regulatory tool,” and also because most information about new financial products is not made public for competitive reasons.¹⁵⁹ To reduce this uncertainty, he considered the possibility of regulation that would institutionalize a “system of information gathering to cope with” ongoing financial innovation.¹⁶⁰ But such a system, he cautioned, could be costly, causing the possible “loss of valuable proprietary information” and tempting financial institutions “to follow regulator-approved models on pain of increased

¹⁵⁶ See *supra* notes 7-11 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 11, at 1309-10.

¹⁵⁷ *Id.* at ___. Efficiency demands that the costs of regulation do not exceed its benefits. 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. Although I believe 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.*

¹⁵⁸ See *supra* note 151 and accompanying text.

¹⁵⁹ See Hu, *supra* note 4, at 1499.

regulatory scrutiny.”¹⁶¹ Even worse, he concluded, regulators may not be sophisticated enough to interpret, and indeed may misinterpret, this information.¹⁶²

Similarly, regulatory attempts to limit uncertainty by standardizing transactions and financial products would likely have unintended negative consequences.¹⁶³ Prof. Gale has argued that investor unfamiliarity with new securities creates “an additional source of uncertainty which is not traceable to the randomness of the underlying asset returns.”¹⁶⁴ Consistent with Gale, this article has described how the complexities of securities involved in the subprime crisis created significant uncertainty.¹⁶⁵ Regulation, though, is probably not the best way to address this uncertainty. Because market conditions change in real time and thus are more fluid than regulatory change, imposing standardization through law would block design innovations needed to adapt securities to changing markets. Standardization appears to be better achieved by market participants themselves, as would occur when investors charge uncertainty premiums.¹⁶⁶

¹⁶⁰ *Id.* at 1503, 1505-06.

¹⁶¹ *Id.* at 1508.

¹⁶² *Id.*

¹⁶³ *Cf. supra* notes 117-119 and accompanying text (discussing unintended negative consequences of accounting regulation).

¹⁶⁴ Douglas Gale, *Standard Securities*, 59 REV. ECON. STUDS. 731, 734 (1992).

¹⁶⁵ *See* Part II.B, *supra*. In this context, it is somewhat ironic that securitization itself is a means of standardizing the underlying assets, securitized assets being “more likely to be considered as part of a standardized class of assets than any one specific mortgage would be.” Hellwig, *supra* note 4, at 13. Prof. Hellwig has “serious doubts,” however, about the second and higher tiers of securitization represented by CDO and ABS CDO securities. Even though these additional layers “will provide for additional risk diversification,” their “benefits seem ephemeral [because investors could diversify with multiple MBS investments] and the potential incentive effects large [e.g., increasing the scope for moral hazard by further diluting incentives for institutions handling the MBS stage to actively control the quality of the mortgages they were packaging].” *Id.* at 23-24.

¹⁶⁶ *Cf. Gale, supra* note 164, at 731 (arguing that investors will charge an “uncertainty premium” on unfamiliar securities). I do not know whether investors charged sufficient uncertainty premiums in the subprime crisis. Any failure to do so may well be due to the other market failures described in this article, such as conflicts of interest. *See infra* notes 292-299 and accompanying text. [Consider the extent to which standardization would help to solve the problem that investors in the originate-to-distribute model may have insufficient incentive to understand each unique investment. Compare similar incentive

Implementing cost-effective supplemental protections therefore appears to be the best approach to the problem of impaired disclosure. These protections could include guaranties by sellers, such as warranties, and governmental and private-sector certifications of quality.¹⁶⁷

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.¹⁶⁸

This approach, however, can sometimes backfire.¹⁶⁹ In the subprime 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.¹⁷⁰ Unfortunately, at least some 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

of much less sophisticated *borrowers* looking at more standardized mortgage products. Cite-SLS]

¹⁶⁷ Schwarcz, *Disclosure’s Failure*, *supra* note 55, at ___.

¹⁶⁸ 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 Clean Up: Investors Need Better Advice on Structured Finance Products*, 26 INT’L FIN. L. REV. 14, 14 (Sept. 2007).

¹⁶⁹ Fitch also notes, *supra* note 168 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”).

sold, the seller inadvertently misleads investors into buying those securities.¹⁷¹ 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,¹⁷² 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.¹⁷³ Still, because investors over time tend to choose higher rates of return over investment discipline,¹⁷⁴ 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 securities.¹⁷⁵ In the subprime crisis, however, rating agencies were said to contribute to the crisis,¹⁷⁶ and there are various proposals under consideration to improve the quality of the rating system.¹⁷⁷ 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

¹⁷⁰ *Protecting Financial Markets*, *supra* note 3, at ___. *Cf.* Hellwig, *supra* note 4, at 16 (observing that “as time went on, ever greater portions of equity tranches were sold to outside investors”).

¹⁷¹ *Protecting Financial Markets*, *supra* note 3, at ___. 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.

¹⁷² *See supra* notes 86-88 and accompanying text.

¹⁷³ *Cf. infra* notes 289-290 and accompanying text (observing that investors tend, over time, to forsake investment discipline for higher rates of return).

¹⁷⁴ *See infra* note 290.

¹⁷⁵ *See supra* note 77 and accompanying text (observing, among other things, that debt securities are rated by their likelihood of timely payment).

¹⁷⁶ *Protecting Financial Markets*, *supra* note 3, at ___.

¹⁷⁷ *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

more capable and more accountable than government analysts due at least in part to the former's higher compensation incentives.¹⁷⁸

These are all only second-best or partial solutions to the problem of uncertainty. 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.¹⁷⁹ And any attempt by government to restrict firms from engaging in complex transactions would be risky because of the potential of inadvertently banning beneficial transactions.¹⁸⁰

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.¹⁸¹ This risk is problematic because market participants are unable to discern how much contingent exposure their counterparties have to other market participants.¹⁸²

been severely undermined, and that market participants should be required to hold additional capital).

¹⁷⁸ *Id.* at ____.

¹⁷⁹ 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).

¹⁸⁰ See *supra* notes 156-157 and accompanying text. See also Gerard Caprio, Jr., Ash Demirguc-Kunt, & Edward J. Kane, “The 2007 Meltdown in Structured Securitization: Searching for Lessons Not Scapegoats” 5 (Nov. 23, 2008 draft), available at www.ssrn/abstract_id=1293169 (observing that “a tightly regulated financial system hampers growth”).

¹⁸¹ See *supra* notes 132-140 and accompanying text.

¹⁸² See *supra* notes 136-138 and accompanying text.

Counterparties can mitigate this risk voluntarily by disclosing their contingent liabilities on credit derivatives. Regulation also can enhance the disclosure, such as by requiring counterparties to credit-derivative transactions, or intermediaries for those parties, to keep a registry of the transactions from which market participants can ascertain risk allocation.¹⁸³ The extent to which enhanced disclosure will prove useful is uncertain, though. Under generally accepted accounting principles (“GAAP”), counterparties are already required to disclose many of their contingent liabilities.¹⁸⁴ However, subtle judgment calls must be made as to how likely a contingency is to occur. If a counterparty assesses the likelihood as higher than it actually is, market participants may unnecessarily avoid doing business with the counterparty. But if the counterparty assesses the likelihood as lower than it actually is, market participants may be under-pricing the risk of doing business with the counterparty.¹⁸⁵

Another hurdle to imposing enhanced disclosure through regulation is that derivatives are chameleon-like—they easily can change form and appearance—and there

¹⁸³ See, e.g., Christopher Cox, Op-Ed, *Swapping Secrecy for Transparency*, N.Y. TIMES, Oct. 19, 2008, at A__ (arguing that “Congress could require that dealers in over-the-counter credit-default swaps publicly report both their trades and the value of those trades”).

¹⁸⁴ 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]

¹⁸⁵ Another possible approach to mitigate counterparty risk might be for CDS contracts, which have many characteristics of insurance (STRUCTURED FINANCE, *supra* note 50, §10:4.1), to be regulated like insurance policies. This approach is beyond this article’s scope.

are myriad ways that risk can be transferred in transactions not regarded as derivatives, such as a simple guarantee for payment of a fee. Even a simple loan agreement can be characterized as a credit derivative.¹⁸⁶ Any regulation of credit derivatives therefore will have to grapple with the problem of defining what is being regulated, with a narrow focus potentially omitting risk transfers that should be covered and a broad focus potentially being overly restrictive by including traditional commercial transactions.

If disclosure-related approaches are inadequate to address the uncertainty and information failures caused by credit derivatives, the next step might be to consider banning or otherwise limiting credit derivatives. This article does not get to that next step.¹⁸⁷ Risk transfer is not inherently bad, and indeed it can maximize efficiency if risk is transferred—as is the goal of credit derivatives—to parties better able to bear the risk.¹⁸⁸ Nonetheless, future research should explore whether, as might have occurred in the subprime crisis, credit derivatives have dispersed risk so broadly as to create a type of collective-action problem: the ultimate risk-bearing parties do not always have sufficient amounts at risk regarding any given underlying credit risk to motivate them to engage in due diligence.¹⁸⁹

¹⁸⁶ *Cf.* 11 U.S.C. § 101(53B) (broadly defining a “swap agreement”). I personally have seen loan transactions structured as swaps, and Professor Hu reports of a case where a bank mistakenly thought a loan was a swap. Hu, *supra* note 4, at 1480. *See also* Hutson v. E.I. du Pont de Nemours & Co. (*In re* National Gas Distributors, LLC), No. 07-2105 (4th Cir., Feb. 11, 2009)(observing that 11 U.S.C. § 101(53B)’s broad definition “barely distinguish[es] any major commercial contract from a swap agreement”). *Cf.* ANDREW M. CHISHOLM, DERIVATIVES DEMYSTIFIED: A STEP-BY-STEP GUIDE TO FORWARDS, FUTURES, SWAPS AND OPTIONS 1 (2004) (defining a derivative as an asset whose value is derived from the value of some other asset known as the underlying); 12 C.F.R. 563.172 (defining a financial derivative as a financial contract whose value depends on the value of one or more underlying assets, indices, or reference rates).

¹⁸⁷ *But cf. supra* notes 156-166 and accompanying text (arguing that proscribing transactions with impaired disclosure would inadvertently ban many beneficial transactions).

¹⁸⁸ REPORT OF THE PRESIDENT’S WORKING GROUP ON FINANCIAL MARKETS, HEDGE FUNDS, LEVERAGE, AND THE LESSONS OF LONG TERM CAPITAL MANAGEMENT __ (1999).

Lastly, it should be recalled that the indirect-holding system for securities increases uncertainty about market participants.¹⁹⁰ 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.¹⁹¹ 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 and turbulent markets, to avoid having to mark its securities portfolio to market by fully disclosing its underlying asset portfolio.¹⁹² This same approach could be used to reduce uncertainty without needing to modify the indirect-holding system.

B. 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.¹⁹³ Nonlinear feedback is especially dangerous when combined with tight coupling.¹⁹⁴

Currently, the most significant such combination is marking to market.¹⁹⁵ Although marking to market generally stabilizes financial markets by creating trust that assets are fairly valued, it destabilizes markets when investors lose confidence during

¹⁸⁹ *Protecting Financial Markets*, *supra* note 3, at ___. Any regulation limiting credit derivatives would similarly have to grapple with the problem of defining what is being regulated. *See supra* note 186 and accompanying text.

¹⁹⁰ *See supra* note 112 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).

¹⁹¹ *See supra* note 111 and accompanying text.

¹⁹² *See infra* notes 202-206 and accompanying text.

¹⁹³ *See supra* notes 124-130 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.

¹⁹⁴ *See* text accompanying note 117, *supra*.

¹⁹⁵ *See supra* notes 117-124 and accompanying text.

times of market turbulence; then, requiring firms to sell assets to meet margin calls can artificially depress asset prices, causing a downward spiral.¹⁹⁶

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.¹⁹⁷ In the case of marking to market, one way to account for the interactive pattern is to recognize, as the subprime crisis has revealed, that liquidity and default are not always correlated.¹⁹⁸ In that crisis, holders of securities that were unaffected by defaults found it difficult to sell or refinance those securities.¹⁹⁹ This difficulty in turn created an even greater crisis of confidence, causing the market to collapse.²⁰⁰ 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.²⁰¹

This downward spiral could have been mitigated, if not prevented, by recognizing that when investors lose confidence and markets become turbulent,²⁰² marking to market can be misleading and potentially dangerous.²⁰³ Although the feedback effect of marking to market dampens price perturbations in normal times, thereby stabilizing the financial

¹⁹⁶ *See id.*

¹⁹⁷ Alan Greenspan, *We Will Never Have a Perfect Model of Risk*, FIN. TIMES, Mar. 17, 2008, at 9.

¹⁹⁸ *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).

¹⁹⁹ *See, e.g.*, Bank of New York v. Montana Bd. Of Investments, [2008] E.W.H.C. 1594 (Ch.) (observing, at paragraph 21 of the opinion, that extreme illiquidity in the structured products markets reduced the market value of the (largely non-defaulted) collateral to significantly less than the present value of the collateral’s expected cash flows).

²⁰⁰ Dibelius, *supra* note 198.

²⁰¹ *See supra* notes 122-123 and accompanying text.

²⁰² *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).

²⁰³ CRMPG III REPORT, *supra* note 57, at 132-33.

system, the feedback effect of marking to market amplifies perturbations when investors lose confidence, thereby de-stabilizing the financial system.²⁰⁴ Regulators then should allow firms to substitute other measures of investor comfort for marking to market. One possible approach, for example,²⁰⁵ 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.²⁰⁶ 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,²⁰⁷ thereby enabling investors and other market participants to make more transparent valuations. This approach also would help reduce the anomaly,²⁰⁸ seen during the subprime crisis, of securities bearing market values substantially below their intrinsic values—the latter representing the present value of the reasonably expected cash flows of those securities.²⁰⁹

²⁰⁴ *Cf. id. Cf. also* “Is the Securitization Crisis Driven by Nonlinear Systemic Processes?,” GUIDE POST (May 12, 2008 blog).

²⁰⁵ Another possible approach, suggested by Professor Ron Blasi, is to base mark-to-market accounting on a trailing average rather than a one-day snapshot of market values. Memorandum from Ronald W. Blasi, Professor of Law, Georgia State University, to the author (Nov. 17, 2008) (on file with author). This approach would at least dampen the amplifying perturbations.

²⁰⁶ This “full disclosure” option has been proposed by Dr. Alexander Dibelius, *supra* note 198, 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).

²⁰⁷ *See supra* note 46 and accompanying text (describing the assets that underlay CDO securities).

²⁰⁸ For an interesting conjecture on whether this indeed is anomalous, *see* Hellwig, *supra* note 4, at 41 (arguing that although the notion that the market value of securities may be significantly below the expected present value of their future cash flows “seems incompatible with the theory of asset pricing in informationally efficient markets,” it can be explained by limitations on investor funds or investor worries about refinancing).

²⁰⁹ *See Understanding the ‘Subprime’ Mortgage Crisis, supra* note 4; International Monetary Fund, *Containing Systemic Risks and Restoring Financial Soundness*, GLOBAL FIN. STABILITY REP. (Apr. 2008) (suggesting that the market prices of at least some mortgage-backed securities may be significantly below the expected present values of their future cash flows). This amount could be measured by examining the mortgage loans underlying the securities and ascertaining which were subprime, which were prime, and which were delinquent or in default, and then estimating the expected present values

As financial markets evolve, other nonlinear feedback effects will undoubtedly become tightly coupled in ways one cannot predict *ex ante*. It is also impossible to know precisely how future financial crises will arise. Consideration therefore should be given to more broad spectrum regulatory solutions.²¹⁰

One such possible approach is to establish a governmental entity to act, if needed, as a market liquidity provider of last resort (hereinafter, “market liquidity provider”) in order to more loosely couple the feedback effects.²¹¹ This approach takes inspiration from chaos theory,²¹² which recognizes that failures are almost inevitable in complex systems, and that successful systems are those in which the consequences of a failure are limited.²¹³ This approach is also consistent with engineering design, in which de-coupling systems through modularity helps to reduce the chance that a failure in one part of a complex system will systemically trigger a failure in another part.²¹⁴ “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.”²¹⁵

of those cash flows). See Simon Gervais & Steven L. Schwarcz, “Valuation of Risky Cash Flows” (working paper on file with author).

²¹⁰ Cf. CRMPG III REPORT, *supra* note 57, at 102 (proposing that a resilient market for credit derivatives requires that shocks be “absorb[ed], rather than amplify[ied]”).

²¹¹ See *infra* notes 213-233 and accompanying text (discussing how a liquidity provider of last resort could more loosely couple financial-market feedback effects). For a discussion of logistical and cost-benefit issues associated with a liquidity provider of last resort, see *infra* notes 233-XX and accompanying text.

²¹² See *supra* note 144 and accompanying text (introducing chaos theory).

²¹³ J.B. Ruhl, *The Arrow of the Law in Modern Administrative States: Using Complexity Theory to Reveal the Diminishing Returns and Increasing Risks the Burgeoning of Law Poses to Society*, 30 U.C. DAVIS L. REV. 405, 467-68 (1997). See also PER BAK, *HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY* __ (1996).

²¹⁴ Charles B. Perrow, *Complexity, Catastrophe, and Modularity*, 78 SOCIOLOGICAL INQUIRY, Issue no. 2, at 162-73 (2008).

²¹⁵ Henry E. Smith, *Panel Four: Boilerplate Versus Contract: Modularity in Contracts: Boilerplate and Information Flow*, 104 MICH. L. R. 1175, 1180 (2006).

Thus, when a component of a system fails, modularity enables repairs to be made before the entire system shuts down.²¹⁶

A market liquidity provider would work in much this same way, providing functional “modularity” to limit the consequences of financial-market failure by directly investing in securities of panicked markets. Financial markets rely critically on the supply of liquidity in the form of credit.²¹⁷ If a failure deprives a particular market of liquidity, a market liquidity provider can restore liquidity before that market collapses and endangers other financial markets.²¹⁸

For example, a market liquidity provider could provide market liquidity²¹⁹ by investing in securities of artificially falling financial markets—markets in which the price of securities falls measurably below the intrinsic value of the assets underlying the securities (which might result from a panic, as occurred in the subprime crisis when mortgage-backed securities prices fell below the present value of the expected cash flows

²¹⁶ *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).

²¹⁷ See *supra* note 108 and accompanying text.

²¹⁸ Cf. Michael D. Bordo, Bruce Misrach, & Anna Schwartz, NBER Working Paper Series (No. 5371), *Real Versus Pseudo-International Systemic Risk: Some Lessons From History* 19 (1995) (observing that financial panic will not usually become contagious when a lender of last resort provides adequate liquidity). In the Great Depression, for example, economists believe that the negative effects would have been considerably muted through actions by the government central bank to provide the needed liquidity to maintain stability within the monetary supply. *Id.* at 21.

²¹⁹ For clarity, this discussion differentiates “market illiquidity,” in which illiquidity in a market causes specific assets in that market to be undervalued, from “funding illiquidity,” in which illiquidity in a market for short-term investments threatens to undermine long-term investments that are funded by the short-term investments. Cf. *infra* notes 223-225 and accompanying text (discussing funding liquidity). Both market illiquidity and funding illiquidity are forms of illiquidity in markets. I thank Laura Ellen Kodres, Chief, Global Financial Stability Division, International Monetary Fund, for pointing out this distinction.

on the underlying mortgages²²⁰)²²¹—thereby stabilizing asset prices and dampening the over-amplification of marking to market that can lead to market collapse.²²²

A market liquidity provider also could address temporary problems of funding illiquidity. This occurs when illiquidity in a market for short-term investments threatens to undermine long-term investments that are funded by the short-term investments. For example, an investment vehicle, such as an asset-backed commercial paper (“ABCP”) securitization conduit,²²³ may fund the purchase of long-term financial assets, such as bonds, by issuing short-term commercial paper, expecting to refinance by issuing new commercial paper (i.e., “rolling over” the commercial paper). If the market for commercial paper is temporarily disrupted, as occurred during the subprime crisis, and the securitization conduit cannot obtain immediate alternative financing, it will default.²²⁴

²²⁰ See *supra* note 209 and accompanying text.

²²¹ The mechanics of timing purchases will be critical. Because markets normally can fluctuate widely, a market liquidity provider should contemplate acting only when fluctuations are outside of normal ranges.

²²² See *supra* notes 117-123 & 202-204 and accompanying text (discussing how marking to market in turbulent financial markets can lead to market collapse). In the subprime crisis, for example, a market liquidity provider could have stepped in to purchase sufficient quantities of mortgage-backed securities to stabilize the MBS markets. Say the intrinsic value of a type of mortgage-backed securities, calculated by taking the present value of the expected value of the cash flows on the mortgage loans backing those securities, is 80 cents on the dollar. If the market price of those securities had fallen to, say, 20 cents on the dollar, the market liquidity provider could purchase these securities at, say, 60 cents on the dollar cash. But it could also agree to pay a higher “deferred purchase price” for securities that turn out to be worth more than expected. The large discount ensures that the market liquidity provider, and thus taxpayers, should not lose money. And the deferred purchase price protects sellers from giving up, or having to write off on their books, too much value. See Steven L. Schwarcz, *The Case for a Market Liquidity Provider of Last Resort*, forthcoming N.Y.U. J. L. & Bus. (2009) (Keynote Address, Law Review Symposium on Modernizing the Financial Regulatory Structure), available at http://ssrn.com/abstract_id=1346542. For an explanation of why, if prices are artificially low, private investors cannot be counted on to invest and make this profit, see *infra* notes 248-254 and accompanying text.

²²³ For a brief primer on ABCP securitization conduits, see Michael Durrer, *Asset Backed Commercial Paper Conduits*, 1 N.C. BANKING INST. 119, 119 (1997).

²²⁴ Policy Statement on Financial Market Developments: The President’s Working Group on Financial Markets, 14 LAW & BUS. REV. AM. 447, 455-56 (2008) (suggesting that

In instances where market participants reasonably use short-term funding to invest in long-term assets and the market illiquidity is unexpected and temporary,²²⁵ a market liquidity provider could consider providing the alternative financing.²²⁶

In these ways, a market liquidity provider not only would reduce the chance of any given financial market collapse by restoring liquidity but also would reduce systemic risk by de-coupling the chance that a failure in one market would trigger a failure in other markets.²²⁷

These roles of a market liquidity provider go substantially beyond the U.S. Federal Reserve's historical actions as lender of last resort to financial institutions, much less the actions of other national central banks. Under the Federal Reserve Act, the Federal Reserve Bank is authorized to, and customarily does, offer loans to banks that need credit.²²⁸ In response to the subprime crisis, the Federal Reserve extended its

some 30% contraction of the ABCP market in the U.S. in 2007 was a factor contributing to the financial crisis).

²²⁵ The conditions that the use of short-term funding to invest in long-term assets be reasonable and that any market illiquidity be unexpected are intended to minimize moral hazard. *See infra* note 240 and accompanying text.

²²⁶ *Cf. Hellwig, supra* note 4, at 39 (observing that “[s]hort of buying the securities themselves, the central-bank intervention [in the subprime crisis] could not eliminate the systemic problem that, with the breakdown of conduit and SIV refinancing, there was a large overhang of long-term asset-backed securities that needed refinancing at a time when the fundamental value of these assets was questionable and the associated risks were seen as a potential threat to any institution that was holding them”). The ability to invest directly in market securities can also protect the integrity of secondary markets for re-sale of securities. Schwarcz, *Systemic Risk, supra* note 4, at 225-28.

²²⁷ *Cf. supra* notes 214-218 and accompanying text (referring to this as functional modularity).

²²⁸ *See, e.g.,* Christopher Anstey & Steve Matthews, *Fed's Direct Loans to Banks Climb to Record Level (Update 2)*, BLOOMBERG, May 15, 2008, <http://www.bloomberg.com/apps/news?pid=20670001&sid=aur2QcWbKf2U>. Section 13(3) of the Federal Reserve Act (12 U.S.C. § 343) enables the Board of Governors of the Federal Reserve System, in “unusual and exigent circumstances,” to “authorize any Federal reserve bank . . . to discount for any individual, partnership, or corporation, notes, drafts, and bills of exchange” if such individual, partnership, or corporation is “unable to secure adequate credit accommodations from other banking institutions.” The publicity about the original “liquidity injections” by the Federal Reserve in response to the

lending availability to “near banks” like investment banks.²²⁹ If needed, the Fed even has power to extend lending availability to any entity, not merely banks and near banks, whose failure might bring down the larger financial system.²³⁰ The extent of the Fed’s power, much less its willingness, to provide liquidity to markets directly is less clear, however.²³¹

Adaptation in that direction is critical, though, because of the ongoing shift, known as disintermediation, of the source of corporate financing from banks to financial and capital markets.²³² This article’s conception of a market liquidity provider would take on this new role of protecting these markets directly. Had such a market liquidity

subprime crisis did not represent direct increases in money availability but merely a lowering of the “discount rate” at which such loans are made, thereby providing a more attractive borrowing environment for banks. *See, e.g.,* Jeremy W. Peters, *The Basics: The Banks Roll Up Their Sleeves*, N.Y. TIMES, Aug. 19, 2007, Wk. in Rev., at 2 (observing that when the Federal Reserve makes “liquidity injections” into the banking system, “the Fed doesn’t even use real money,” and explaining that liquidity results from offering Fed loans to banks at the discount rate, a lower interest rate than the “fed funds rate” that banks would charge other banks on interbank loans). Moreover, that “liquidity injection” affected only banks, not non-banks or financial markets. *See* Kim Clark, *Fed ‘Injections’: Who Benefits?*, U.S. NEWS & WORLD REP., Aug. 15, 2007, at [cite] (explaining that the Fed is merely “lending to banks that need the funds and charging them interest”); Jeremy W. Peters, *The Banks Roll Up Their Sleeves*, N.Y. TIMES, Aug. 19, 2007, at [cite] (discussing the Federal Reserve’s ability to “inject” liquidity by lending money to banks so that they do not have to borrow elsewhere at higher interest rates).

²²⁹ Federal Reserve Chairman Ben Bernanke, testimony before the House Financial Services Committee, *Transcript of the Hearing of the House Financial Services Committee, Systemic Risk and the Financial Markets*, Federal News Service, July 10, 2008.

²³⁰ *See supra* note 228 (referencing Section 13(3) of the Federal Reserve Act, which enables the Board of Governors of the Federal Reserve System, in “unusual and exigent circumstances,” to “authorize any Federal reserve bank . . . to discount *for any individual, partnership, or corporation*, notes, drafts, and bills of exchange”) (emphasis added). 12 U.S.C. § 343 (2008).

²³¹ [Update to Emergency Economic Stabilization Act of 2008 and to Obama’s revised financial bailout plan, discussed *infra* note 255. cite]

²³² Schwarcz, *Systemic Risk*, *supra* note 4, at 200. *Cf.* Mortimer B. Zuckerman, *No Time to Lose*, U.S. NEWS & WORLD REP., Mar. 2009, at 80 (observing that securitization “once accounted for 70 percent of our credit while conventional bank lending has dropped to 30 percent. Unless financial firms can securitize debt and, in turn, rely on investors willing to buy [securities representing] the bundled loans, credit will remain extremely tight.”).

provider been in existence when the subprime crisis started, the resulting collapse of the credit markets may well have been restricted in scope and lessened in impact.²³³

The above discussion begs the question of whether these potential benefits of using a market liquidity provider would exceed its costs. As shown below, a market liquidity provider should generate relatively minimal costs, and certainly lower costs than those of a lender of last resort to institutions.²³⁴ In related contexts, I have shown the relevant costs to be taxpayer expense and moral hazard.²³⁵ By providing a lifeline to financial institutions, a lender of last resort fosters moral hazard by potentially encouraging these institutions—especially those that believe they are “too big to fail”—to be fiscally reckless.²³⁶ Moreover, loans made to these institutions will not be repaid if the institutions eventually fail.

²³³ Schwarcz, *Systemic Risk*, *supra* note 4, at 229, 248-49. *See also supra* notes 220-222 and accompanying text.

²³⁴ Another way to help transform our tightly-coupled financial system into one that is more weakly coupled would be to require near banks (*see supra* note 229 and accompanying text, defining “near banks”) to maintain minimum capital requirements, like banks. Capital requirements, however, are very expensive. *See, e.g.*, Michael E. Bleier, *Operational Risk in Basel II*, 8 N.C. BANKING INST. 101, 103-04 (April 2004) (“The new capital requirement for operational risk can be fairly expensive for specialized financial institutions with significant concentration in asset management, custody, and other businesses that would, for the first time carry a capital requirement.”); Raj Bhala, *Banking Law Symposium: Applying Equilibrium Theory and the Ficas Model: A Case Study of Capital Adequacy and Currency Trading*, 41 ST. LOUIS L.J. 125, 132 (1996) (observing that “the greater the capital requirements, the more expensive it is to trade in the markets”).

²³⁵ *See* Schwarcz, *Systemic Risk*, *supra* note 4, at 225-30; Steven L. Schwarcz, *Sovereign Debt Restructuring: A Bankruptcy Reorganization Approach*, 85 CORNELL L. REV. 956, 961-66 (2000).

²³⁶ *See, e.g.*, Gary H. Stern & Ron J. Feldman, *Too Big to Fail: The Hazards of Bank Bailouts* (2004); Robert L. Hetzel, *Too Big to Fail: Origins, Consequences, and Outlook*, FED. RES. BANK OF RICHMOND ECON. REV. 3 (Nov.-Dec. 1991). Although ideally a lender of last resort should adopt a policy of “constructive ambiguity” in its lending decisions and further restrict its lending to entities that are merely experiencing temporary liquidity crises but that otherwise are financially healthy (Schwarcz, *Systemic Risk*, *supra* note 4, at 226-27), these restrictions may not be politically viable if the entity’s failure would negatively impact the real economy. *See Finance and Economics: Not Yet the Last Resort*, Economics Focus, THE ECONOMIST, Oct. 11, 2008, at 108

In contrast, a market liquidity provider, especially if it acts at the outset of a market panic, can profitably invest in securities at a deep discount from the original market price and still provide a “floor” to how low the market will drop.²³⁷ Indeed, this article proposes that a market liquidity provider should consider providing market liquidity *only* when it believes it can profit (or at least break even) because its mission should be to correct market failures, such as might be caused by a panic or other investor overreaction.²³⁸ Moral hazard should also be minimized: speculative investors will be hurt by the market liquidity provider’s deeply discounted purchases,²³⁹ and investing in markets, not institutions directly, should reduce rent-seeking behavior by institutions that believe they are too big to be allowed to fail.²⁴⁰ Additionally, by stabilizing financial markets, a market liquidity provider will minimize the likelihood that institutions invested or insuring risk in those markets will ultimately fail, further reducing the times when a lender of last resort would be needed. If financial markets had not broken down, for example, institutions like Bear Stearns, AIG, and Citigroup would not have needed to

(asserting that “the political risks of doing too little and letting the economy slide” may outweigh restrictions on loans by the Fed).

²³⁷ See *supra* notes 220-226 and accompanying text (explaining why, in the subprime crisis, a market liquidity provider could have profitably purchased mortgage-backed securities at a deep discount and still have stabilized the market significantly above the present disastrous levels).

²³⁸ See *supra* notes 218-222 and *infra* notes 249-250 and accompanying text.

²³⁹ Investor moral hazard can be further limited if the market liquidity provider adopts a policy of constructive ambiguity, not stating *ex ante* whether or not it will attempt to stabilize any given market panic and not indicating in advance the purchase price it would offer if it were to attempt to do so. *Systemic Risk*, *supra* note 4, at 226-27. Investor moral hazard cannot be eliminated, however, because certain markets may be so important that investors can predict their stabilization with a high degree of certainty.

²⁴⁰ In contrast, a market liquidity provider used to finance temporary problems of funding illiquidity (see *supra* notes 222-226 and accompanying text) could increase moral hazard to the extent market participants use less care in addressing funding gaps. This article’s proposal—that a market liquidity provider consider providing such financing only when market participants have reasonably used short-term funding to invest in long-term assets and the subsequent market illiquidity is unexpected—is intended to minimize that moral hazard. See *supra* note 225.

be bailed out.²⁴¹ In economic terms, therefore, any safety-net subsidies created by a market liquidity provider will be much smaller than those created by a lender of last resort.²⁴²

Perhaps for these reasons, the United States Department of the Treasury, responding to the possible collapse of Fannie Mae and Freddie Mac, announced in September 2008 that it would purchase securities issued by Fannie and Freddie to the extent investors do not do so, thereby stabilizing the mortgage-backed securities markets and reducing mortgage rates.²⁴³ This was the first time that any government entity agreed to act in a market-liquidity-provider capacity.²⁴⁴

One might ask whether failed efforts of governments to try to control their currency exchange rates indicate that a market liquidity provider, even if governmental, would have insufficient spending power to stabilize irrationally panicked debt markets. Only Hong Kong was able to control its currency exchange rate, and that was because its

²⁴¹ *Understanding the ‘Subprime’ Financial Crisis*, *supra* note 4, at [cite] (explaining that the collapse in financial-market prices meant that banks and other financial institutions holding securities in those markets had to write down their value, causing these institutions to appear more financially risky, in turn triggering lack of confidence and concern over counterparty risk).

²⁴² *Cf.* Caprio, Demirguc-Kunt, & Kane, *supra* note 180, at 9 (arguing that the goal of financial regulation and supervision is “to manage the [regulatory] safety net so that private risk-taking is neither taxed nor subsidized”); *id.* at 6 (arguing that, ideally, regulated parties should not have opportunities to “shift the deep downside of their risk exposures onto the [regulatory] safety net”).

²⁴³ Statement by Henry M. Paulson, Secretary of the Treasury, United States Department of the Treasury, “Treasury and Federal Housing Finance Agency Action to Protect Financial Markets and Taxpayers” (Sep. 7, 2008). Although this was one of four steps announced by Secretary Paulson to address the problems of Fannie Mae and Freddie Mac, the other steps—placing these entities into conservatorship, committing to purchase senior-priority preferred stock in these entities to maintain a positive net worth, and establishing a secured lending credit facility for these entities—would have no application to stabilizing financial markets generally.

²⁴⁴ In recent months, the United States has tried to restore market confidence by “provid[ing] direct financing to businesses by buying three-month commercial paper . . . [and] provid[ing] loans to banks and other financial institutions that buy asset-backed commercial paper from money-market mutual funds.” Michael M. Grynbaum, *Fed Adds to Its Efforts to Aid Credit Markets*, N.Y. TIMES, Oct. 22, 2008, at B1.

reserves, which implicitly included all of China's reserves, were large enough to be credible.²⁴⁵ There are important distinctions, though, between controlling a currency exchange rate and stabilizing an irrationally panicked debt market. Controlling a currency exchange rate depends on all of the macroeconomic factors to which the country in question is subject whereas stabilizing a panicked debt market depends mostly on factors specific to the debt securities in question. Also, because the market liquidity provider should consider acting only when a panicked debt market is so irrational that the market value of its securities falls measurably below their intrinsic value,²⁴⁶ the market liquidity provider should be able to stem the information asymmetry leading to this valuation differential by explaining the irrationality and, by buying at an above-market price, putting its money where its mouth is.²⁴⁷ It effectively would be providing to investors in that debt market the same type of real credibility and comfort that a country's large reserves provide to currency investors.²⁴⁸

²⁴⁵ Mark L. Clifford, *Hong Kong's Currency Cop; Joseph Yam's Duty: Defend the Dollar Against All Comers*, BUS. WK., Sept. 23, 1996, at 60 (discussing Hong Kong's currency controls and China's tacit approval thereof).

²⁴⁶ See *supra* notes 219-221 and accompanying text. The market liquidity provider also could act to prevent funding illiquidity, but the amounts needed for that purpose should be relatively small.

²⁴⁷ The ability of a market liquidity provider to stabilize market prices might have particular problems in a thin market that does not react responsively to its purchases. In the subprime crisis, for example, at least a portion of the MBS markets, including those for ABS CDO securities, were privately-placed debt markets. Nonetheless, there was a virtual market for ABS CDO securities, created by the ABX.HE indices. This virtual market was sufficiently large that it should have reacted responsively to purchases made by a market liquidity provider. [cite] (The ABX.HE indices simulate the risk and reward of trading in asset- and mortgage-backed securities. A potential investor, for example, can decide to invest in asset-backed securities represented by one of the indices, without actually purchasing the underlying securities. The investor is thus not limited to specific securities, or to amounts of those securities that are actually physically available for purchase. The ABX.HE indices also help to facilitate hedging. A lender, dealer, or hedge fund with excessive asset-backed securities exposure, for example, not only can attempt to buy protection from counterparties but now can also hedge its exposure through the indices. [cite])

²⁴⁸ Any analogy of a market liquidity provider to The Bank of Japan's failed attempt to support the Tokyo Stock Exchange's Nikkei index would also be inappropriate. The Nikkei is an index of shares of 225 companies selected to be representative of the Tokyo Stock Exchange as a whole and thus the price of those shares turns on a multitude of macroeconomic factors, including Japan's financial condition.

One also might ask why, if a market liquidity provider can invest in securities at a deep discount to stabilize markets and still make money, private investors will not also do so. Part of the answer is that individuals at investing firms may not want to jeopardize their reputations (and jobs) by causing their firms to invest at a time when other investors have abandoned the market.²⁴⁹ Empirical evidence confirms that individuals engage in this type of “herd behavior.”²⁵⁰ Private investors are also risk averse,²⁵¹ and the fact that disclosure has become so complex that investors are uncertain how much securities are worth increases the perception, if not reality, of risk. Private investors also would have greater real risk if—as almost certainly would be the case—the size of their investment is insufficient to ensure market stabilization. They then face the risk that a continuing fall in market prices could systemically impact the real economy (such as by shutting down credit markets, as occurred in the subprime crisis), thereby jeopardizing even the intrinsic value of their purchased securities.²⁵² Furthermore, even if they are confident that the intrinsic value of the purchased securities exceeds the amount of their investment,²⁵³ they

²⁴⁹ See, e.g., Tyler Cowen, *It's Hard to Thaw a Frozen Market*, N.Y. TIMES, Mar. 23, 2008, at BU 5 (asking why, in the context of the subprime crisis, “asset prices don’t simply fall enough so that someone buys them and trading picks up again”; and answering: “why seek ‘fire sale’ prices when you might lose your job for doing so?”).

²⁵⁰ Cf. Paul M. Healy & Krishna Palepu, *Governance and Intermediation Problems in Capital Markets: Evidence from the Fall of Enron* 26 (Aug. 15, 2002 draft, available at www.ssrn.com) (forthcoming in J. ECON. PERSP.) (observing that fund manager who estimates a stock is overvalued but does not act on this analysis “and simply follows the crowd” will not be rewarded for foreseeing the problems, “but neither will he be blamed for a poor investment decision when the stock ultimately crashes, since his peers made the same mistake”); Stephen M. Bainbridge, *Mandatory Disclosure: A Behavioral Analysis*, 68 U. CIN. L. REV. 1023, 1038 (2000) (discussing how herd behavior may have a reputational payoff even if the chosen course of action fails, and arguing that where “the action was consistent with approved conventional wisdom, the hit to the manager’s reputation from an adverse outcome is reduced”).

²⁵¹ JONATHAN BERK & PETER DEMARZO, *CORPORATE FINANCE* 69 (2007).

²⁵² Recall that intrinsic value of mortgage-backed securities is measured by first examining which mortgage loans underlying those securities are subprime, which are prime, and which are delinquent or in default. See *supra* note 209. If an obligor on a previously-prime mortgage loan loses her job because the real economy is impacted, that loan may become delinquent or defaulted and, in any event, should likely be re-categorized as subprime, thereby reducing its intrinsic value.

²⁵³ See *supra* note 209 and accompanying text.

may not want to risk having to wait until maturity of the securities to profit.²⁵⁴ A market liquidity provider with the ability to invest sufficiently large amounts to stabilize markets and also, if necessary, to wait until maturity is needed to correct these market failures.

It should be noted, however, that a market liquidity provider need not necessarily have to invest government funds, at least at the outset, to correct these market failures. Rather than purchasing securities directly, a market liquidity provider could take a more targeted approach to stabilizing panicked markets by entering into derivatives contracts to strip out risks that the market has the greatest difficulty hedging—in effect, the market’s irrationality element—thereby stimulating private investment. The Obama Administration in the United States presently appears to be considering this type of public-private-partnership approach in its revised financial bailout plan.²⁵⁵ By not actually purchasing securities directly, a market liquidity provider would appear to be taking less investment risk and thus its function may be seen as more politically acceptable.²⁵⁶

C. Addressing Failures Arising from Misalignment

Complexity causes several types of misalignment that can give rise to financial-market failures.²⁵⁷ Consider first misalignment caused by the originate-to-distribute model, which can lead to moral hazard (which, in turn, is said to cause lax lending standards) and collective-action problems.²⁵⁸ Because this model is critical to the funding

²⁵⁴ This risk is exacerbated if the market value of undervalued securities is still falling because investors then would not even break even on near-term resale of the securities. *Cf. Kravitt, supra* note 16, at [cite] (asking, “Who wants to buy securities that will have to be marked down tomorrow, even if one expects them to be worth more eventually?”).

²⁵⁵ Floyd Norris, *U.S. Bank Bailout to Rely in Part on Private Money*, N.Y. TIMES, Feb. 9, 2009, at A1 (reporting that the revised bailout plan would likely depend in part on private investors, such as hedge funds, private-equity funds, and perhaps insurance companies, buying distressed MBS, with the U.S. Government guaranteeing a floor value to the securities purchased).

²⁵⁶ *Cf. id.* (observing that having the government purchase the distressed MBS securities directly would be a “politically perilous course”).

²⁵⁷ *Cf. supra* note 149 (noting that this article does not cover all types of conflicts that could cause market failure, just those that result from complexity).

²⁵⁸ *See supra* notes 30-37 and accompanying text.

liquidity of banks²⁵⁹ and corporations,²⁶⁰ this article assumes the model will continue notwithstanding its complexity. The article explores possible solutions on that basis.²⁶¹

The moral hazard problem arises because the originate-to-distribute model misaligns the interests of the lenders with the interests of the ultimate owners of the loans.²⁶² In theory, separation of origination and ownership should not matter because ultimate owners should assess and value risk before buying their ownership positions.²⁶³ 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.²⁶⁴ 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.²⁶⁵

²⁵⁹ 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-to-distribute model).

²⁶⁰ 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-to-distribute model has created value in the financial markets).

²⁶¹ 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).

²⁶² See *supra* notes 34-35 and accompanying text.

²⁶³ Cf. Policy Statement on Financial Market Developments, *supra* note 224, at 451-52, 455 (recommending that investors normally make informed decisions about risk, but noting that in the subprime crisis investors over-relied on ratings instead of engaging in their own independent credit analysis because the securities were so complex).

²⁶⁴ *Id.*

²⁶⁵ See *supra* note 40 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).

As one solution to the moral hazard problem caused by this misalignment, regulators could require loan originators to retain some realistic risk of loss.²⁶⁶ This solution, though, would still face the mutual-misinformation problem.²⁶⁷ The solution also would not necessarily apply to mortgage- and other loan-brokers, who sometimes work with banks and finance companies to help make loans to borrowers.²⁶⁸ Because these “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.²⁶⁹ 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.²⁷⁰

Misalignment caused by the originate-to-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.²⁷¹ 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 documentation²⁷² provides for hiring a servicer to act on behalf of the investors who beneficially own the loans.²⁷³

²⁶⁶ *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) (stating that the originate-to-distribute model creates moral hazard by relieving the originator of any risk of loss once the loan is sold).

²⁶⁷ *See supra* notes 170-172 and accompanying text.

²⁶⁸ A mortgage broker markets mortgage loans and brings lenders and borrowers together. BLACK’S LAW DICTIONARY 206 (8th ed. 2004). *Compare* Wyatt v. Union Mortg. Co., 598 P.2d 45 (Cal. 1979) (“A mortgage loan broker is customarily retained by a borrower to act as the borrower’s agent in negotiating an acceptable loan”) with 24 C.F.R. § 3500.7(a)(4)-(b) (describing a mortgage broker as a lender’s agent).

²⁶⁹ *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”).

²⁷⁰ [Expand this conclusion. cite]

²⁷¹ *See supra* notes 42-43 and accompanying text.

²⁷² This is usually in the so-called “pooling and servicing agreement.”

²⁷³ 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*

In the subprime 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,²⁷⁴ 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.²⁷⁵ More significantly, servicers often preferred foreclosure over restructuring because the former is more ministerial and thus has lower litigation risk.²⁷⁶ 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.²⁷⁷ A restructuring that, for example, reduced the interest rate would adversely affect investors in the interest-only tranche,²⁷⁸ leading to what some have called “tranche warfare.”²⁷⁹

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).

²⁷⁴ Gretchen Morgenson, *More Home Foreclosures Loom as Owners Face Mortgage Maze*, N.Y. TIMES, Aug. 6, 2007, at A1.

²⁷⁵ *Protecting Financial Markets*, *supra* note 3, at __.

²⁷⁶ *Protecting Financial Markets*, *supra* note 3, at __.

²⁷⁷ Jon D. Van Gorp, “Capital Markets Dispersion of Subprime Mortgage Risk” 10 (unpublished Nov. 2007 manuscript, on file with author), at 7-8.

²⁷⁸ 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.

²⁷⁹ Telephone Interview with Hirsch, *supra* note 40 (describing tranche conflicts as a significant reason why servicers choose foreclosure over restructuring). The term, “tranche warfare,” was originally coined in Kurt Eggert, *Held Up in Due Course: Predatory Lending, Securitization, and The Holder in Due Course Doctrine*, 35 CREIGHTON L. REV. 503, 563 (2002).

Regulation may well be needed to address the servicing problem in existing transactions, where the underlying deal documentation is already in place.²⁸⁰ But future deal documentation would be expected to address the problem without the need for regulation, such as by including clearer and more flexible servicing guidelines, more certain reimbursement procedures for loan restructuring (when the servicer determines that restructuring is superior to foreclosure), and contractual immunity from liability for servicers that act in good faith.²⁸¹

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 are not failsafe because the servicer is not usually independent of the company originating the underlying financial assets.²⁸² An affiliated servicer can manipulate monitoring in ways that are undetectable unless investors, or their agents, micromanage all uses and sources of cash,²⁸³ which might not be cost effective.

Misalignment that facilitates fraud can be addressed either by using a servicer independent of the company if there is any doubt of the servicer's integrity, 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

²⁸⁰ Regulatory 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. One regulatory change I would favor is to grant servicers the same type of business-judgment rule limited immunity from lawsuits that corporate directors presently enjoy, as a means to motivate servicers to exercise their judgment in good faith without fear of liability. *Cf.* Steven L. Schwarcz & Gregory M. Sergi, *Bond Defaults and the Dilemma of the Indenture Trustee*, 59 ALA. L. REV. 1037 (2008) (advocating this type of limited immunity for indenture trustees on public debt issues).

²⁸¹ Misalignment also can result in a collective-action problem to the extent the originate-to-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.

²⁸² *See supra* note 102 and accompanying text.

²⁸³ *See supra* notes 103-107 and accompanying text.

collections from those assets, the most straightforward solution when in doubt of the servicer's integrity is to use an independent servicer.²⁸⁴

In practice, asset-backed securities transactions may evolve in the direction of more frequently using independent, third-party servicers to increase investor comfort.²⁸⁵ This evolution is likely to be gradual because, at least currently, few independent parties have the needed servicing expertise and experience to cost-effectively perform in this capacity.²⁸⁶ Nonetheless, there is evidence that the market is beginning to respond, such as the decision by Bank of America to purchase Countrywide Financial Corp., partly in order to gain “greater scale in . . . servicing mortgages.”²⁸⁷

If the market takes steps to correct itself in this manner, there should be no need for regulation requiring the use of independent servicers. Indeed, parties should have the flexibility to decide not to use independent servicers where they trust a servicer affiliated with the company originating the financial assets. There is nothing intrinsically wrong or unusual for parties in business transactions to deal with each other on the basis of trust.²⁸⁸

²⁸⁴ 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.

²⁸⁵ Cf. STRUCTURED FINANCE, *supra* note 50, §4:5 at 4-9 (citing *Lloyds & Scottish Fin. Ltd. v. Cyril Lord Carpets Sales Ltd.*, H.L. (Mar. 29, 1979); *People v. Serv. Inst., Inc.*, 421 N.Y.S.2d 325 (Sup. Court Suffolk County 1979)).

²⁸⁶ See *supra* note 102 and accompanying text.

²⁸⁷ Press Release, “Bank of America Agrees to Purchase Countrywide Financial Corp.,” Jan. 11, 2008.

²⁸⁸ 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

And some transactions may be beneficial even taking into account the increased possibility of fraud absent an independent servicer.²⁸⁹

The potential to ultimately impose this 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.”²⁹⁰ There may come a time when regulation, or its threat, is needed to restore market discipline.²⁹¹

Finally, misalignment can cause failure when conflicts exist among a firm’s managers, such as when investment analysts resort to simplifying heuristics when analyzing highly complex securities²⁹² or manipulate models for their pecuniary advantage.²⁹³ This can be addressed by better aligning management compensation incentives with the long-term interests of the firm,²⁹⁴ such as retroactively recovering

crucial role in creating and managing alliances because it reduces complex realities far more quickly and economically than prediction, authority or bargaining).

²⁸⁹ Cf. *supra* note 157 (discussing cost-benefit analysis).

²⁹⁰ 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).

²⁹¹ Compare *supra* notes 173-190 and accompanying text.

²⁹² See *supra* notes 59-62 and accompanying text.

²⁹³ See *supra* notes 71-76 and accompanying text (discussing how investment analysts manipulated VaR modeling). Cf. Hu, *supra* note 4, at 1492-93 (discussing how a trader “engaged in derivatives operations may emphasize rewards and downplay risks”).

²⁹⁴ Cf. CRMPG III REPORT, *supra* note 57, 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”). Sections 111(b)(2)(A)-(C) of The Emergency Economic Stabilization Act of 2008 requires, in a

compensation paid to managers or paying a portion of compensation contingently over time or in the form of equity securities with long-term lock-down constraints on selling the securities.²⁹⁵ Better alignment of compensation and firm interests also would have mitigated a similar problem of misalignment in hedge funds; certain losses of institutional investors in the subprime crisis appear to have resulted from losses in CDO investments by controlled or managed hedge funds.²⁹⁶ Because 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,”²⁹⁷ they had significant conflicts of interest with the institutions owning the funds.

Firms have incentives, and are in a better position than government regulators, to determine how best to align their long-term interests with manager compensation. Alignment is difficult to achieve, however, because individual firms that attempt to align incentives will be disadvantaged in their ability to compete for the best managers.²⁹⁸ Regulation may well be needed to help resolve this collective-action problem.²⁹⁹

D. Regulatory Lessons

The foregoing analysis has shown that market participants themselves can, and indeed should have incentives to, address many of the market failures resulting from

limited context, that firms take a more long-term view to compensation to avoid conflicts in the way that managers are paid, receiving high compensations and bonuses for arranging deals or investments that later fail.

²⁹⁵ See *Conflicts and Financial Collapse*, *supra* note 149, at [cite] (examining these compensation alternatives in detail). Cf. Arthur B. Laby, *Differentiating Gatekeepers*, 1 BROOK. J. CORP. FIN. & COM. L. 119, 159-60 (2006), citing Tom Johnson, *The 2005 All-America Research Team*, INSTITUTIONAL INVESTOR, Oct. 1, 2005, at 54, 81 (“Sell-side analysts, for example, are generally not compensated based solely on investment performance. Buy-side firms rate, and presumably pay, sell-side analysts based on factors other than performance, including timeliness of information, responsiveness, innovation, and comprehensibility of research reports”).

²⁹⁶ Kate Kelly, Serena Ng & David Reilly, *Two Big Funds At Bear Stearns Face Shutdown—As Rescue Plan Falters Amid Subprime Woes, Merrill Asserts Claims*, WALL. ST. J., June 20, 2007, at A1.

²⁹⁷ James Surowiecki, *Performance-Pay Perplexes*, NEW YORKER, Nov. 12, 2007, at 34.

²⁹⁸ *Conflicts and Financial Collapse*, *supra* note 149, at [cite].

²⁹⁹ *Id.*

complexity. For example, market participants should have incentives to charge uncertainty premiums,³⁰⁰ to draft servicing agreements with clearer and more flexible servicing guidelines,³⁰¹ to demand the use of independent third-party servicers,³⁰² and to require that loan originators retain a realistic risk exposure.³⁰³ The analysis also has shown that unnecessary regulation should be avoided to minimize unintended, often adverse, consequences.³⁰⁴

Nonetheless, there are specific areas in which regulation—or at least the threat of regulation—may well be necessary. Besides helping to resolve the collective-action problem discussed above,³⁰⁵ 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.³⁰⁶ Regulation can require credit-derivative transactions to be centrally registered so that market participants have more information about counterparty risk.³⁰⁷ Regulation also can speed the adoption of desirable market changes—for example, by eliminating the time needed for existing contracts to be replaced.³⁰⁸ 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 valuation³⁰⁹

³⁰⁰ See *supra* note 166 and accompanying text.

³⁰¹ See *supra* notes 280-281 and accompanying text.

³⁰² See *supra* notes 283-289 and accompanying text.

³⁰³ See *supra* notes 262-269 and accompanying text (though holding open a solution under which regulators require loan originators to retain that risk exposure).

³⁰⁴ See *supra* notes 117-118 & 163-165 and accompanying text. Indeed, chaos theory suggests that one unintended consequence of overregulation is that by preventing small financial-market collapses, it might divert attention from the potential for a greater systemic collapse. Cf. Ruhl, *The Arrow of the Law in Modern Administrative States*, *supra* note 213, at [cite] (observing that small collapses can enhance the stability of complex systems “the way an area of tectonic activity might produce thousands of small tremors in order to avoid a severe earthquake”); BAK, *supra* note 213, at [cite] (first positing how small collapses can enhance complex system stability).

³⁰⁵ See *supra* notes 298-299 and accompanying text.

³⁰⁶ See *supra* note 206 and accompanying text.

³⁰⁷ See *supra* notes 183-186 and accompanying text (cautioning, however, that it is uncertain how useful this enhanced disclosure will prove).

³⁰⁸ See *supra* note 273 and accompanying text.

³⁰⁹ See *supra* note 173 and accompanying text.

and to ensure that investors give appropriate consideration to the need for independent third-party servicing³¹⁰ and avoid inappropriate exclusive reliance upon credit ratings.³¹¹

Because it is impossible to predict precisely how complexities might cause future evolving financial markets to fail, this article offers no general prescriptive framework for regulating complexity per se. Nonetheless, the analysis has shown that regulators can generally mitigate the consequences of these failures by creating a market liquidity provider of last resort to de-couple the risk of failures being systemically transmitted.³¹²

To the extent regulators consider promulgating any of these regulatory responses, they should note that complexity inserts a particular twist into the ongoing debate over whether regulation should 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,³¹³ and principles-based regulation is better suited to govern changing scenarios.³¹⁴ Rules could be overly constraining or could simply lose their effectiveness.³¹⁵

Perhaps for this reason, the United Kingdom's Financial Services Authority (FSA) is moving to more of a principles-based approach.³¹⁶ Similarly, in the United States, the Financial Accounting Standards Board (FASB) is shifting GAAP from rules-

³¹⁰ See *supra* notes 290-291 and accompanying text.

³¹¹ See *supra* note 59 and accompanying text.

³¹² See *supra* notes 211-256 and accompanying text.

³¹³ Cf. JOHNSON, JEFFERIES, & HUI, *supra* note 125, at ___ (noting that fluctuations in evolving financial markets are difficult to model ex ante because previously observed statistical patterns do not always continue).

³¹⁴ Cristie L. Ford, *New Governance, Compliance, and Principles-Based Securities Regulation*, 45 AM. BUS. L.J. 1, 2 n. 8 (2008) (citing the SEC's recent establishment of a principles-based definition and disclosure requirements for asset-backed securities).

³¹⁵ *Id.* at 60 ("Principles-based regulation and outcome-oriented regulation are responses to a visceral recognition that traditional, rule-oriented legal regimes are limited in their ability to deal with some broader organizational and cultural problems").

³¹⁶ FINANCIAL SERVICES AUTHORITY, PRINCIPLES-BASED REGULATION, FOCUSING ON THE OUTCOMES THAT MATTER (Apr. 2007).

based to more principles-based³¹⁷ and, to some extent, the emphasis of supervisory practices likewise appears to be shifting to a more principles-based approach.³¹⁸

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.”³¹⁹ Without such shared assumptions and procedures, regulated parties will be unable to predict the consequences of their actions.³²⁰ Regulators need information from industry to remain relevant, just as industry needs information from regulators to remain compliant.³²¹ 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.”³²²

This suggests a potential dilemma: as investment securities and financial markets become increasingly internationalized and more complex, making principles-based regulation more attractive as a means to adapt given principles to different legal systems, it will become increasingly harder for regulators and market participants to act together

³¹⁷ Financial Accounting Standards Board, *Proposal for a Principles-Based Approach to U.S. Standard Setting*, File Reference No. 1125-001 (Oct. 21, 2002), available at http://www.fasb.org/proposals/principles-based_approach.pdf (last visited Aug. 27, 2008); Financial Accounting Standards Board, *FASB Response to SEC Study on the Adoption of a Principles-Based Accounting System* (July 2004), available at http://www.fasb.org/response_sec_study_july2004.pdf (last visited Aug. 27, 2008).

³¹⁸ CRMPG III REPORT, *supra* note 57, at 137.

³¹⁹ Julia Black, *Using Rules Effectively*, in REGULATION AND DEREGULATION 95, __ (C. McCrudden ed., 1999).

³²⁰ *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”).

³²¹ 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).

as a community. That, in turn, will make principles-based regulation less effective.³²³ Regulators and market participants will have to remain cognizant of this limitation.

IV. CONCLUSIONS

As the subprime 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.³²⁴ But it is harmful to the extent it triggers the market failures described in this article, “mak[ing] crises inevitable.”³²⁵ Ultimately it is necessary to find a balance through market adaptation and, when needed, regulation.

This article attempts to strike that balance. To this end, the article first examines the ways in which complexity can cause markets to fail. 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, obscuring 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 have characteristics of complexities in engineering systems with nonlinear feedback and the failures themselves are characteristic of failures in those systems, the article’s analysis in part takes a law and engineering approach.

³²² Elizabeth Derbes, “The Subprime Crisis: U.S. Regulatory Responses and Lessons Learned” ¶ V.B.3 (2008 unpublished manuscript, on file with author).

³²³ [Provide a concrete example from the regulation proposed in this article. cite]

³²⁴ See *supra* notes 6-11 and accompanying text.

³²⁵ BOOKSTABER, *supra* note 70, at 5.

That approach reveals that, just as there are no general laws for complexity, there are no general laws for regulating complexity. Complexity not only makes it impossible to predict how future financial crises will arise but also makes it more likely that regulation can lead to unintended, and often adverse, consequences.³²⁶ To help solve this regulatory dilemma, the article proposes, among other things, that regulators create a market liquidity provider of last resort having the power to invest in securities of panicked markets or, as circumstances warrant, to hedge irrational elements of a market panic, thereby stimulating private investment in these securities.³²⁷ By so stabilizing market prices—especially when those prices fall measurably below the intrinsic value of the securities, such as occurred in the subprime crisis³²⁸—such a market liquidity provider would address the very consequences of market failure, dampening the over-amplification of marking to market that can lead to market collapse and reducing systemic risk by de-coupling the chance that a failure in one market will trigger a failure in other markets.

This solution takes inspiration from chaos theory and engineering design, which recognize that failures are almost inevitable in complex systems and that successful systems are those in which the consequences of a failure are limited. A market liquidity provider would work to limit the consequences of inevitable financial-market failures.

This article’s conception of a market liquidity provider of last resort for financial markets goes substantially beyond the traditional focus of the U.S. Federal Reserve and foreign central banks, as lenders of last resort to financial institutions. An additional focus on markets is needed to reflect the increasing shift of corporate financing from

³²⁶ [Consider commenting, as applicable, on regulation proposed when this article goes to press. cite]

³²⁷ *See supra* notes 248-256 and accompanying text (discussing market failures that deter private investment and how hedging can re-stimulate that investment).

³²⁸ *See supra* notes 208-209 and accompanying text (examining how to measure when prices of securities fall below their intrinsic value). This article indeed proposes, to minimize moral hazard, that a market liquidity provider of last resort should consider providing market liquidity *only* when it believes it can profit or at least break even. A

banks and other financial institutions to financial markets.³²⁹ Furthermore, because its mission is to correct market failure, a market liquidity provider should be able to invest profitably and still stabilize market prices.³³⁰ This should not create a taxpayer burden—and, indeed, a market liquidity provider could be largely privately funded. Any moral-hazard costs are likely to be minimal, or at least substantially lower than the moral-hazard costs created by a lender of last resort to institutions. Moreover, a market liquidity provider could even minimize the moral-hazard problem of governments being forced to prop up financial institutions that are deemed “too big to fail.”³³¹ A market liquidity provider, if institutionalized, also should work more effectively than ad hoc market-liquidity approaches such as those attempted during the subprime crisis. Market stabilization is much easier to achieve at the outset of a panic, before it becomes a self-fulfilling prophecy cutting off credit and cratering the real economy.³³²

market liquidity provider’s mission should be solely to correct market failures. *See supra* notes 237-240 and accompanying text.

³²⁹ The Obama Administration’s recently-proposed revised financial bailout plan appears to recognize this reality. *See supra* note 255 and accompanying text (observing that government backing of the market for distressed MBS is an important element of this plan).

³³⁰ *See supra* notes 237-238 and 249-250 and accompanying text.

³³¹ *See supra* notes 235-242 and accompanying text.

³³² Contrast this article’s market-liquidity-provider concept with the ad hoc approaches over the past year of the Bush and Obama administrations. As discussed, the U.S. Treasury Department’s proposal in September 2008 to use government money to purchase mortgage-backed securities issued by Fannie Mae and Freddie Mac was the first attempt by government to stabilize markets by purchasing securities. *See supra* notes 243-244 and accompanying text. These purchases, however, did not address the much larger problem of mortgage-backed securities that are not already effectively government-guaranteed. The Emergency Economic Stabilization Act of 2008 also contemplated government purchases of mortgage-backed securities, but its funds were used for other purposes. Ross Kerber & Robert Weisman, *Bailout Retooled to Boost Lending*, BOSTON GLOBE, Nov. 13, 2008, at [cite]. The more recent Term Asset-Backed Securities Loan Facility, or TALF, contemplated investing government funds in certain consumer-asset-backed securities to reduce consumer financing costs. Scott Lanman & Sarah Mulholland, *Fed May Need to Recast TALF on Commercial Real Estate (Update2)*, BLOOMBERG, Feb. 23, 2009, <http://www.bloomberg.com/apps/news?pid=20601068&sid=aeVjBaVLQNgY&refer=economy>. And the Obama Administration presently appears to be considering an approach under which private investors purchase mortgage-backed securities with government hedging. *See supra* note 255 and accompanying text. Although these approaches are good

The solutions offered by this article, 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. Future study of complexity in financial markets may further benefit from ongoing engineering research, where a variety of modeling approaches are being employed to understand nonlinear interactive patterns.³³³ Any regulation based on that research should nonetheless be approached with caution. An analysis based on models is dependent on the underlying assumptions, and we do not yet know enough about financial markets to be certain of the assumptions.³³⁴

beginnings, they may well be too little, too late. By waiting so long, it has become harder to stabilize markets because of the systemic impact of the subprime crisis. The real economy is shrinking and individuals are losing their jobs, making it more likely that obligors on assets backing even prime securities will default.

³³³ See, e.g., Burkett et al., *supra* note 117 (discussing research in ecosystem engineering that uses a variety of modeling approaches to understand nonlinear patterns). For example, scientists 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 cascading changes that ultimately deplete the lake’s dissolved oxygen. *Id.* at 360. Traditional linear models can significantly overstate acceptable phosphorous levels because such models disregard nonlinearities such as threshold and feedback effects. *Id.* These are the same types of nonlinearities that exist in financial markets.

³³⁴ Cf. 10th William Taylor Memorial Lecture, *Credit Markets and the Economic Crisis: Hearing Before the S. Comm. on Banking, Housing and Urban Affairs*, available through Federal News Service (Oct. 16, 2008) or at http://banking.senate.gov/public/files/LUDWIGSenateBankingHearingRecord_TaylorLecture_Final_092508.pdf (Oct. 16, 2008) (statement of Eugene Ludwig, Chief Executive Officer, Promontory Financial Group) (stating that “it is widely accepted” now that the subprime mortgage securitization models used by rating agencies and other market participants relied on “insufficient data and faulty assumptions”); Karl S. Okamoto, *After the Bailout: Regulating Systemic Moral Hazard* 23 (Oct. 30, 2008 unpublished draft manuscript, on file with author) (observing that underlying the subprime financial crisis “was an enormous [and unjustified] faith in the market’s ability to analyze and measure risk”). Investor panic leading to the subprime crisis may have been triggered, ironically, by incorrect modeling assumptions. Cf. *supra* notes 87-88 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).